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Archaeological and environmental investigations of a Lateglacial and Holocene river sedimentary sequence on the River Soar at Croft, Leicestershire, UK

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Abstract: The sediments, stratigraphy and archaeology of several sections through Lateglacial and Holocene deposits associated with the past course of the Thurlston Brook at Croft, Leicestershire, UK are outlined. The results of pollen, plant macrofossil and insect analyses from these deposits are presented and this information is used to provide a detailed reconstruction of changing river conditions and human land use at this location during the Holocene. Despite the presence of hiatuses in the record seen at Croft, and other sites of this scale, with accurate work and clear dating controls it is possible to 'stitch' together continuous detailed sequences. The general pattern of Holocene landscape and fluvial change appears to echo that seen in the Trent valley region and nationally. It is suggested that small headwater catchments such as at Croft have the potential to provide detailed and sensitive records of Holocene events comparable with those from 'standard' sediment sequences.

Key words: Environmental archaeology, sediments, pollen, plant macrofossils, palaeoentomology, alluviation, river valley development, Leicestershire, early Holocene.

Introduction

The River Trent (Figure 1) has the second largest catchment area in the UK. It drains an area of approximately 7490 km^2 and is approximately 149 km long (Ward, 1981). The river rises from a number of tributaries draining the Staffordshire moorlands and, in its upper and middle stretch, flows eastward as far as Newark on Trent. Tributaries such as the Dove, Derwent and Sour join the Trent in this mid-section and drain large areas of the Derbyshire peaks, forming a network of confluences along a 15 km section of the river. The joint input of these tributaries results in the Trent having the highest annual discharge in the UK (82.21 m^3/s). Above Newark upon Trent

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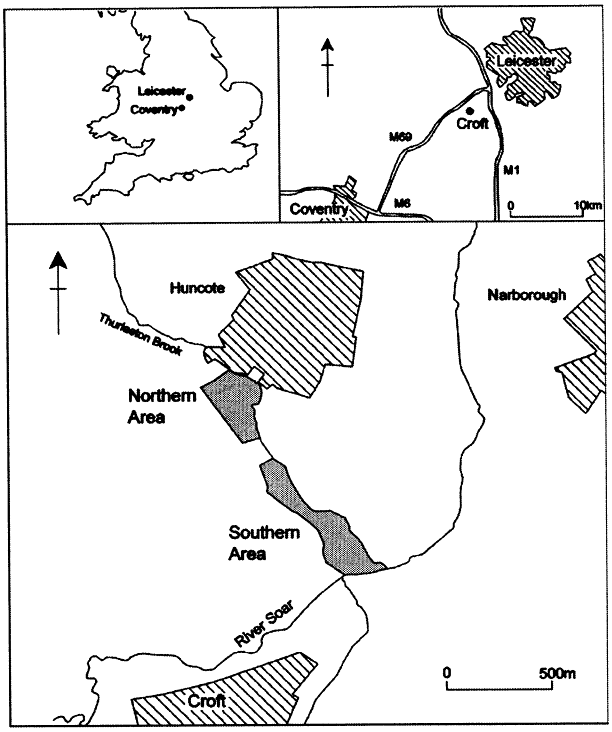

Figure 1 Location of Croft Quarry, Leicestershire

the river swings northwards and drains, via the River Humber, into the North Sea.

The alluvial history of the upper and middle Trent has been investigated in some detail, with the bulk of this work summarized in Knight and Howard (1994, 1995, 2005). The Trent appears to follow the same sequence of river development seen in many other lowland catchments in the UK throughout the Holocene (Macklin and Needham, 1992; Macklin, 1999). A relatively short period of braided river behaviour between *c*. 9500 and 9000 appears to be replaced by a floodplain-wide anasotomising river system mainly reworking gravel and sand substrates until *c.* 800–300 BC. Channel change is mainly by avulsion during this period. Though there do appear to be specific periods of raised flood activity and rising water-tables during this period, their impact on both river and human activity is not clear (Brown and Keough, 1992; Brown *et al*., 1994, 2001; Howard *et al*. 1999). From *c.* 800 BC there appears to be widespread deposition of clay alluvium in the Trent Valley system (Knight and Howard, 1994, 1995, 2005). However, unusually for a lowland river in Britain, the Trent appears to remain unalluviated and continues to rework gravels around its main confluences until at least the Late Mediaeval period (Knight and Howard, 1984, 1985, Brown *et al*., 2001).

The development of the landscape of this important river and its valley is less well understood. Though palaeoenvironmental evidence has been investigated from many individual sites, often this has concentrated on a single period or a short sedimental sequence. This situation primarily results from the episodic pattern of deposition and preservation of material in the valley but also from the nature of its archaeological exploration (Greenwood and Smith, 2005). The clear exception in terms of these sites is the continuous pollen and insect spectra recovered from dated deposits at Bole Ings, Nottinghamshire, where a clear sequence of landscape change for the middle Trent has been reconstructed (Dinnin, 1997; Brayshay and Dinnin, 1999).

Research aims at Croft

The archaeological, sedimentological and palaeoenvironmental work undertaken on the past course of the Thurleston Brook at Croft had a number of clear research aims. Primarily it was hoped that Croft would provide an opportunity to confirm and add detail to the proposed models of fluvial and landscape change suggested for the River Sour (Brown and Keough, 1992; Brown *et al*., 1994) and the Trent (Knight and Howard, 1994, 1995, 2005). Furthermore, there was a possibility that small catchments such as this would be more sensitive in their response to climate and land-use change. Smaller drainage systems might 'record' events that would be effectively 'blurred' by the depositional and taphonomic problems associated with larger river systems. Croft could also function as a test case to see if information from individual deposits with a wide range of differing dates could be 'stitched' together to form a continuous and logical sequence of events. Though several sites in the Trent catchment, noticeably those around the main confluences, do contain sediment 'pockets' from differing periods, there has been no previous deliberate attempt to link such deposits across time to form a coherent picture. Given the rarity of continuous sequences of Holocene sediments in the Trent valley, because of reworking of bed materials by the river during the Holocene, demonstrating that such an approach is successful is of importance in the region. Lastly, it was hopped that the archaeology of the floodplain itself might allow us to see how settlement and the use of the river valley have changed in response to both fluvial and landscape change over time.

Local background

Croft Quarry, Leicestershire, lies approximately 11 km to the southwest of Leicester, UK (Figure 1) and is located to the southwest (centred on SP517968) of Thurlaston Brook near to its confluence with the River Soar (Figures 1 and 2). The site is 67 m above the Ordnance Datum (OD). Thurlaston Brook's catchment is in the region of *c.* 56 km^2. This is comparable with the upstream catchment of the Soar at 63 km^2. The catchments of both watercourses are low-lying, below 130 m OD. The underlying geology is Triassic Mercia Mudstone Group (Bridge *et al*., 1998). This is overlain by glacial sediments belonging to the Wolston glacial Succession (the Oadby till). Though there is debate over the specific age of this deposit, Bridge *et al*. (1998) have suggested an association with a late advance of the Anglian ice sheet. Several valleys in the area also contain Devensian sand and gravel river terrace deposits. All of the valleys in the area contain up to 6 m of later Holocene alluvium (Bridge *et al*., 1998). Aerial photographs and the 1:5000 Ordnance Survey map of the area suggest the presence of a number of abandoned channels on both sides of Thurlaston Brook.

Field walking to the east of the Thurlaston Brook has revealed prehistoric flint clusters and isolated scatters of Iron Age, Roman and Anglo-Saxon material in the form of pottery, coins and metalwork (Cooper, 1993). There is also evidence for a Bronze Age ring ditch in the same area. Aerial photography also records the presence of an undated rectilinear crop mark to the north of the area and an undated double ditch crop mark to the southwest (Cooper, 1993).

Excavation and sampling methodology

In 1993 expansion to the quarry at Croft by CAMAS Quarry Limited necessitated the construction of a substantial 'sound

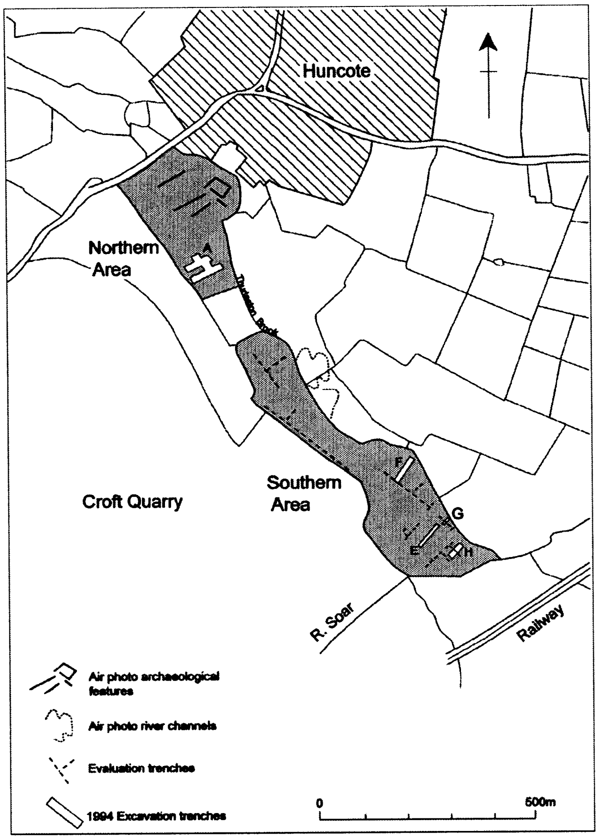

Figure 2 Location of the excavated areas at Croft Quarry, Leicestershire

barrier' or berm. This would effectively cover an area of suspected archaeological value and investigation was warranted. Cooper's (1993) initial evaluation excavations, on behalf of the Leicestershire Archaeology Unit, identified three areas with archaeological and palaeoenvironmental potential:

(1) a northern area where several archaeological features of unknown date were found;
(2) a southern area with possible Neolithic features;
(3) a central area where peat was identified, possibly infilling palaeochannels.

During the subsequent excavations by the Birmingham University Field Archaeology Unit in 1994 (Hughes and Roseff, 1996) the north and south areas (Figure 2, Trench A and H, respectively) were investigated by removing the topsoil by machine down to the underlying gravel and then hand-excavating and recording any visible features. Both areas produced prehistoric features and stone tools. The results from these areas are described below.

Three machine-excavated trenches were dug in the central area of the site. Trenches E and G (Figure 2) were intended to form a transect running for 100 m across the floodplain. Unfortunately only a limited area of the palaeochannel indicated by the evaluation (Cooper, 1993) was encountered in the extreme northeast end of trench G and, as a result, this work was halted.

Trench F (Figure 2), also from the central area, was found to contain the greatest expanse of organic layers and was, as a result, the main locus for environmental sampling and investigation. This 'steeped' trench was machine-excavated to a depth of 2–3 m and for a length of approximately 70 m, giving a partial cross-section through the valley fills. The east-facing profile was hand-cleaned and recorded at a scale of 1:20 with the various stratigraphic units encountered being interpreted and recorded on site.

Environmental sampling occurred from five locations in trench F (sample sites α–ε, Figure 3). These areas were selected because of the existence of organic preservation and because they appeared to represent discrete periods of activity or interest in the stratigraphy. Sample sites α and β came from two channels that were suspected to be glacial or early Holocene in date and were sampled only for pollen using monolith tins. Sample site ε, a discreet block of fibrous peat, was sampled since it was clearly different from the rest of the material in the profile. It was sampled at regular intervals for pollen and by a single bulk sample for plant macrofossils and insect remains. Sample site δ was sampled intensively because it was felt that this represented the best-preserved organic section. Here, sequences of monolith tins were inserted to give a continuous pollen profile. An additional sequence of bulk samples for plant macrofossils and insect remains were also taken. Sampling site χ was initially only intended to produce material to function as 'back up' for the plant macrofossil and insect samples from site δ, since it was initially believed to be of the same date. Later analysis of the stratigraphy on site and the dating program results suggested that this area of the site was a separate channel of an earlier date. At this stage spot samples for pollen were taken directly from the plant macrofossils and insect samples.

Samples for radiocarbon dating were taken on site if it was thought they might date the sediment units. Primarily, fragments of waterlogged branch wood from secure contexts were selected. Occasionally, however, sediment samples had to be used. The context details, laboratory numbers and calibrations of the dates are also presented in Table 1. The dates presented in this text are calibrated using the OxCal program (Bronk Ramsey, 2000) and are to two standard deviations.

Environmental analysis

Pollen (by Simon Butler and Anthony Brown)

The pollen samples were disaggregated in a hot 3% solution of sodium pyrophosphate, followed by sieving at 150 and 10 μm. Two sievings and swirlings in cold 3% sodium pyrophosphate produced very clean, pollen-rich residues. These were analysed under $\times$500 magnification until approximately 400–500 terrestrial pollen grains had been identified. The pollen results from Unit 3 are presented in Table 2. The TILIA and TILIA-GRAPH programs of E.C. Grim, Illinois State University, were used to produce the pollen diagrams in Figures 4 and 5. These show the relative proportion (%) of each pollen taxon in each subsample, with spore and aquatic taxa omitted from the pollen sum. Spore and aquatic taxa are shown as percentages of the total pollen + total spore or + total aquatic sum. Relative abundances of less than 3% for any single taxon are represented on the diagrams by black dots. The Mesolithic and Neolithic pollen results from sampling sites β, χ and ε are displayed in Figure 4. Each sample has been plotted separately rather than as a series of joined points, forming a sequence, since there is often not a clear connection between them in terms of the stratigraphy. The Iron Age results from sampling site δ are displayed in Figure 5. In this case the data is displayed as joined points since the samples were taken as a continuous sequence from the monolith tins.

Plant macrofossils (by A. Monkton)

A total of 21 samples were assessed, of which nine were found to be suitably rich for full analysis. A 300 ml subsample of each

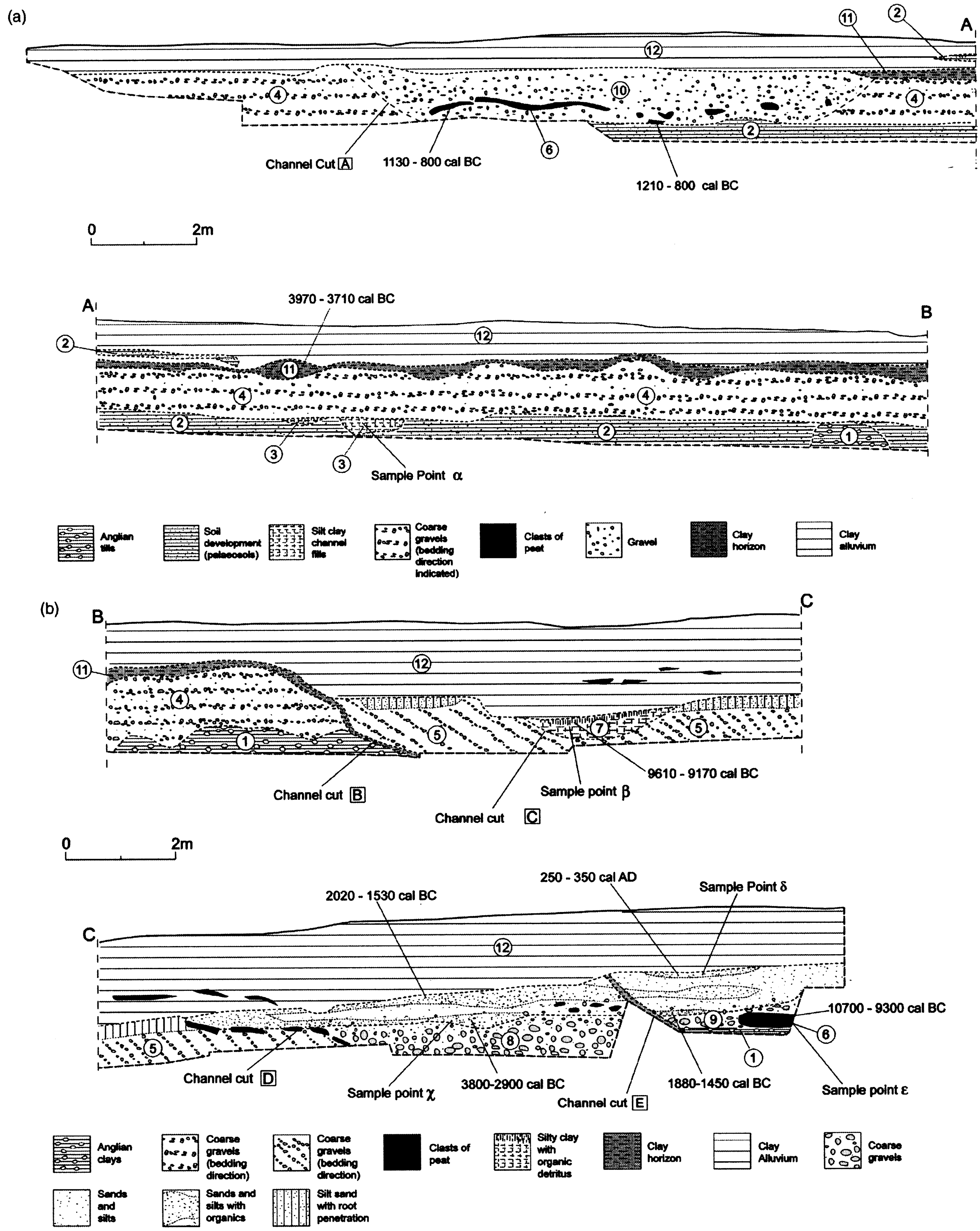

Figure 3 Stratigraphic section from trench F, Croft Quarry, Leicestershire

of the selected samples was soaked in 2% solution of sodium bicarbonate to disperse any clay and then washed over into a 0.18 mm mesh sieve. The entire residue was sorted with a stereomicroscope at $\times 20$ and plant remains identified between $\times 60$ and $\times 100$. Identifications were confirmed by comparison with modern reference material. The flora is listed in Table 3. The nomenclature follows Stace (1997). Remains are seeds unless otherwise stated. The plants were listed by their most common habitats. Some plants can occur in a number of habitats, so a certain amount of overlap may be possible. In

Table 1 The Radiocarbon dates from Croft Quarry, Leicestershire

Lab no.	Sample no.	Material	Result (BP)	Calibrated 1σ (cal.BC)	Calibrated 2σ (cal.BC)	Context
Beta75196	CR/94 4	peat	10220±100	10400–9650	10700–9300	Tr F Unit 6
Beta75197	CR/94 28	hazel	3360±80	1740–1530	1880–1450	Tr F Unit 9
Beta75198	CR/94 38	peat	9840±70	9350–9220	9610–9170	Tr F Unit 7
Beta74199	CR/94 40	peat	4670±160	3650–3100	3800–2900	Tr F Unit 8
Beta75200	CR/94 60	birch	2790±80	1020–830	1130–800	Tr F Unit 10
Beta78006	CR/94 75	ash	3470±80	1890–1680	2020–1530	Tr F Unit 8
Beta78005	CR/94 19	peat	1960±100	100 BC–220 AD	250 BC–350 AD	Tr F Unit 9
GrA-1336	CR/94 6a	oak	5054±45	3950–3790	3970–3710	Tr F Unit 11
GrA-1364	CR/94 F11	Prunus	5600±45	4460–4360	4530–4340	Tr H
GrA-1365	CR/94 47	birch	2770±45	980–830	1010–820	Tr F Unit 10
GrA-1394	CR/94 67	hazel	2910±45	1210–1010	1260–940	Tr H

Calibrations from Bronk (2000).

addition, the habitats of plants today may not have been the same in the past. The plant macrofossils discussed here (see Table 3) are from eight main groupings: aquatic, marsh or wetland, waterside, wood or scrub, open damp or wet ground, open disturbed ground, grassland and unclassified.

Beetle analysis (by David Smith)

The samples were prepared following the method of paraffin flotation outlined in Kenward *et al.* (1980). The resultant flot was sorted at ×20 using a low-power, binocular microscope, and the Coleoptera (beetles) were identified by direct comparison with the Gorham Collection of British Beetles held at The University of Birmingham. The species recovered are listed in Table 4. The taxonomy and nomenclature follows that of Lucht (1987). The species present have been divided into habitat groups following the scheme suggested by Robinson (1981, 1983). An additional ecological grouping has been added. This is the proportion of species from fast-flowing waters expressed as a percentage of the aquatic species present. The proportions of the dung, grassland and woodland ecological groupings are presented as a percentage of the whole terrestrial fauna. The proportions for each of the groupings from the ten samples are presented in Table 5 and Figure 6.

Table 2 The pollen from 5–6 cm in the profile at sample site α at Croft Quarry, Leicestershire

Type	No. of grains	%TLP
Trees and shrubs		
Betula	14	4
Corylus	1	+
Pinus	59	18
Picea	1	+
Larix	2	+
Salix	2	+
Total trees and shrubs	79	25
Dwarf shrubs		
Ericaceae und.	1	+
Vaccinium	1	+
Total dwarf shrubs	2	+
Herbs		
Poaceae	106	33
Cyperaceae	111	35
Artemisia	1	+
Blackstonia perfiolata	1	+
Campanula	1	+
Helianthemum	11	3
Lactuceae und.	4	1
Montia fontana	1	+
Ranunculus t.	1	+
Saxifragaceae	1	+
Stellaria holostea	1	+
Total Herbs	239	75
Aquatics		
Myriophyllum spicatum	8	3
Pteridophytes and Bryophytes		
Selaginella	2	+
Filicales und.	1	+
Fungal and Algal Spores		
Spirogyra 342d	1	+
Other		
Pre-Quaternary	4	1
Unidentified	5	2

A reduced sum has been used, which is 320 Total Land Pollen.

Sedimentology and stratigraphy of trench F

The complex sequence of deposits in trench F is described in detail in Table 6 and illustrated in Figure 3. The relationships and interpretation of the stratigraphic units are also described in this table, along with the dating controls for the various units.

The majority of the excavated trench is dominated by fluvial deposits of glacial age. At the base a dark grey chalk-flecked clay (Unit 1) represents a till of Anglian date that underlies the whole trench. This was overlain by a palaeosol (Unit 2) containing lenticular structures suggestive of ice wedging, indicating that the soil developed under periglacial conditions probably during the Late Devensian (Dimlington) Stadial (>13 000 ka BP). A small channel (Unit 3) filled with dark silt, and marked by a clear basal erosion boundary, subsequently cuts into the till (Unit 3). Its place in the stratigraphy suggests that it dates from the Allerød (Windermere) Interstadial (13 000–11 000 BP). This unit contained environmental sampling site α.

These deposits are subsequently covered by approximately a 2 m-thick horizontally bedded gravel and sand layer that formed a terrace (Unit 4). The stratigraphic position of Unit 4 suggests that it probably dates to the Younger Dryas (Loch Lomond) Stadial (11 000–10 000 BP). Although the deposition of other gravel-dominated deposits in the catchment of the Trent, such as at Colwick (Salisbury *et al.*, 1984), Hemington (Salisbury, 1992) and Langford (Howard *et al.*, 1999), have been proven to have a late Holocene date, this situation is ruled out at Croft by the stratigraphic position.

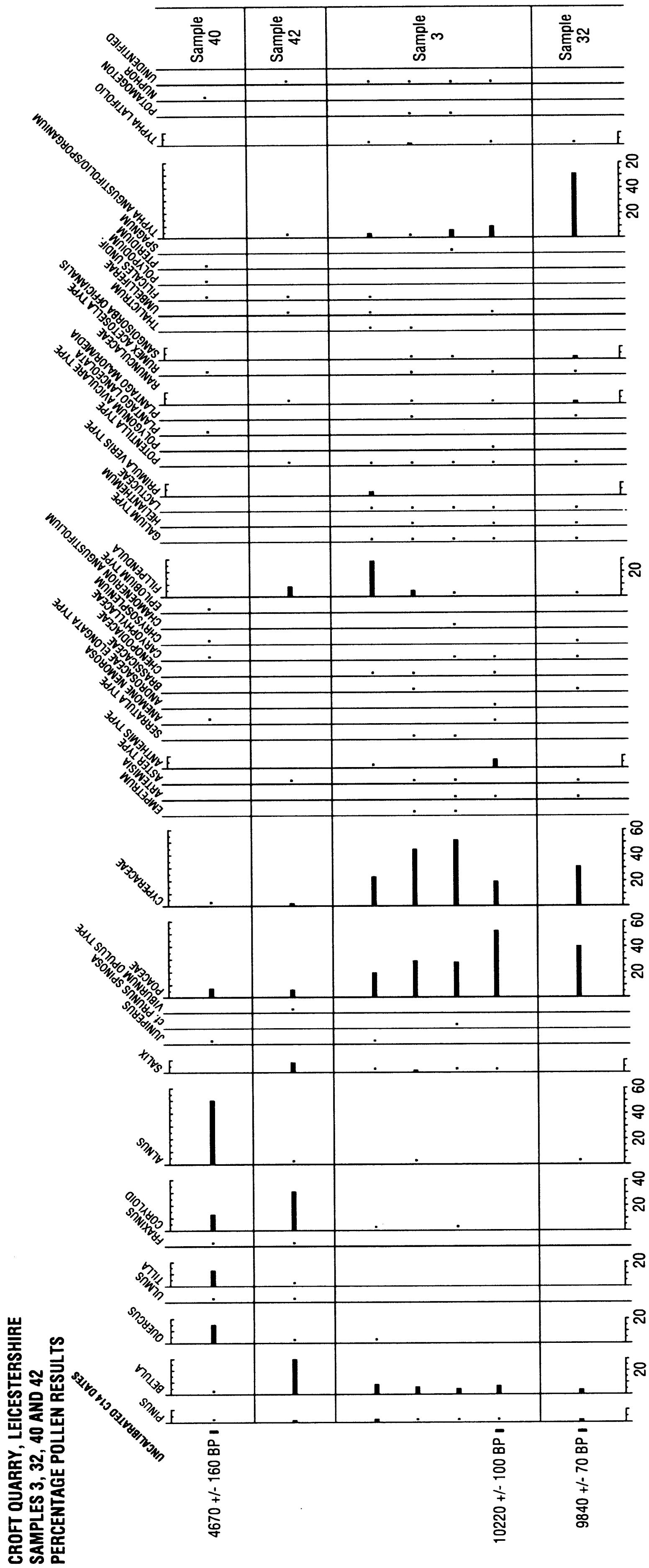

Figure 4 The pollen spectra from the Mesolithic and Neolithic deposits from Croft Quarry, Leicestershire

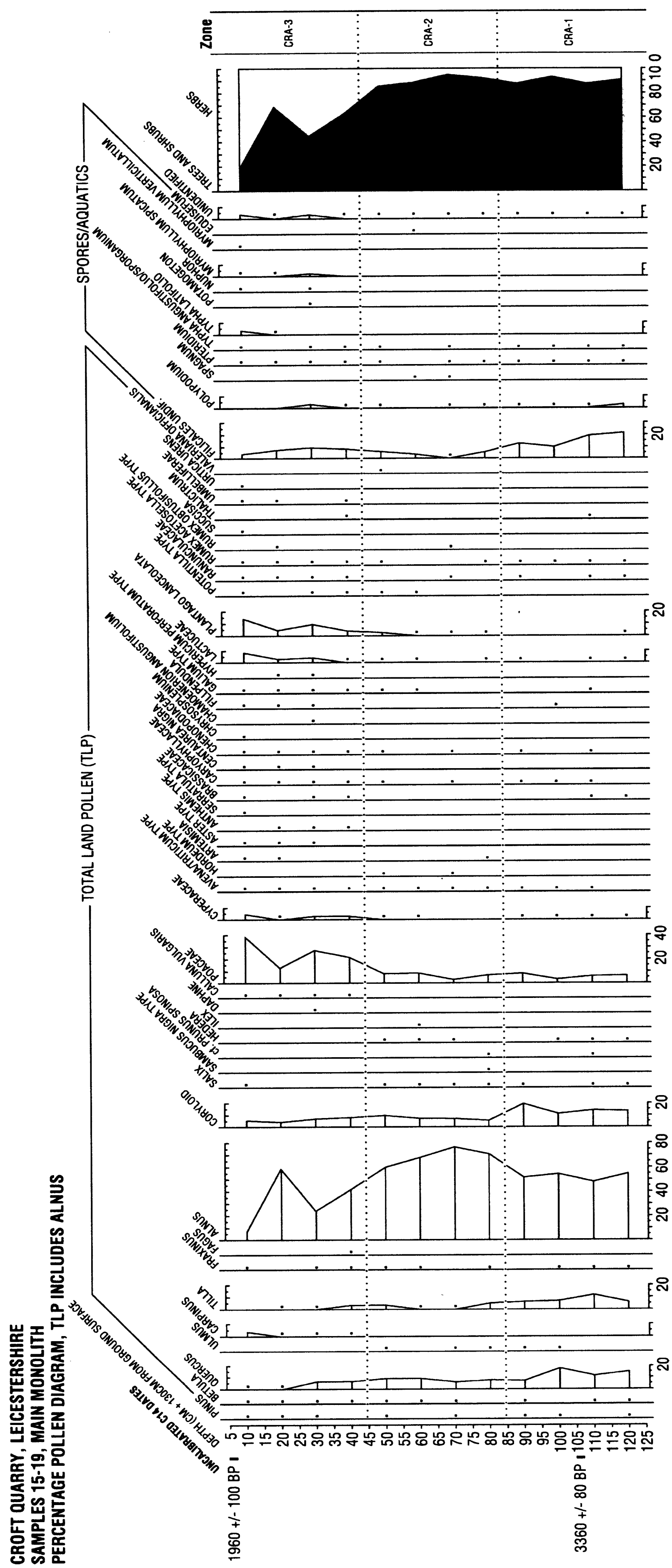

Figure 5 The pollen spectra from the Iron Age monolith from Croft Quarry, Leicestershire

Table 3 The plant macrofossils from the sampled deposits at Croft, Leicestershire

	Sample number									
	6	42	41	40	25	23	22	21	20	
Aquatic										
Nuphar lutea (L.) Smith	–	–	1	1	–	1	–	–	–	Yellow Water-lily
Ceratophyllum sp.	–	–	–	–	–	–	–	–	1	Hornwort
Ranunculus subgen *Batrachium*	1	1	1	–	1	–	–	1	1	Crowfoot
Rorippa sp.	1	–	–	–	–	–	–	1	1	Water-cress
Hippuris vulgaris L.	4	5	–	–	–	–	–	–	–	Mare's tail
Myriophyllum spicatum L.	–	–	–	–	–	1	–	18	51	Water-milfoil
Callitriche sp.	–	–	–	1	1	–	1	4	–	Water-starwort
Alisma plantago aquatica L.	5	–	–	–	2	–	1	11	18	Water-plantain
Potomogeton sp.	1	7	–	–	–	–	1	2	5	Pondweed
Zostera sp.	–	–	–	–	–	–	–	1	–	Eelgrass
Chara sp.	3	–	–	–	–	–	–	5	39	Stonewort
Marsh or wetland										
Juncus spp.	–	–	–	–	2	2	1	11	52	Rushes
cf *Eriophorum* sp.	1	–	–	–	–	–	–	–	–	Cottongrass
Schoenoplectus lacustris (L.) *Palla*	312	653	13	–	1	1	1	3	7	Club-rush
Sparganium sp.	–	7	–	–	2	–	3	–	–	Bur-reed
Typha sp.	1	–	–	–	–	–	–	–	–	Bulrush
Sphagnum sp.	+	+	–	+	–	–	–	–	–	Moss
Waterside										
Stellaria palustris Retz.	–	–	–	1	2	2	4	3	–	Marsh Stitchwort
Polygonum hydropiper (L.) Spach.	–	–	–	12	22	28	16	1	1	Water-pepper
Rumex cf *aquaticus* L.	–	–	–	–	–	–	–	1	–	Scottish Dock
Filipendula ulmaria (L.) Maxim	–	–	–	–	–	1	–	–	–	Meadowsweet
Oenanthe aquatica (L.) Poiret	–	–	–	1	–	1	–	1	–	Water-dropwort
Lycopus europaeus L.	–	2	–	–	–	–	1	1	–	Gipsywort
Wood or scrub										
Quercus sp. (acorn)	–	–	–	1	–	–	–	–	–	Oak
Betula sp.	–	2	–	2	–	–	–	–	–	Birch
Alnus sp. catkins	–	–	5	3	11	26	17	2	1	Alder
Alnus glutinosa (L.) Gaertner	–	–	–	89	52	93	62	–	1	Alder
Corylus avellana L.	–	12	–	–	1	1	–	–	–	Hazel
Stellaria holostea L.	–	–	–	–	–	–	1	–	–	Greater Stitchwort
Silene dioica (L.) Clairv.	–	–	–	–	–	5	5	–	–	Red Campion
Tilia sp. (fruit)	–	–	–	2	–	–	–	–	–	Lime
Rubus fruticosus agg.	–	–	1	4	1	6	2	–	1	Bramble
Mercurialis perennis L.	–	–	–	1	1	1	–	–	–	Dog's Mercury
Ajuga reptans L.	–	–	1	1	–	–	–	–	–	Bugle
Sambucus nigra L.	–	–	1	19	16	17	18	3	3	Elder
Open damp or wet ground										
Ranunculus sp.	3	–	3	1	–	–	2	–	–	Buttercup
Ranunculus acris/repens/bulbosus	3	–	3	1	10	27	8	7	5	Buttercup
Urtica dioica L.	–	6	1	25	2	11	19	6	2	Common Nettle
Montia fontana ssp. *fontana* L.	–	1	2	7	–	3	–	1	–	Blinks
Stellaria cf. *neglecta*	–	1	3	10	5	21	13	1	–	Greater Chickweed
Lychnis flos-cuculi L.	–	2	1	4	3	4	5	–	–	Ragged-Robin
Hypericum sp.	–	–	–	–	–	–	–	1	–	St John's-wort
Stachys sp.	–	–	–	–	1	2	–	–	–	Woundworts
Ballota nigra L.	–	–	–	–	1	1	–	–	–	Black Horehound
Open damp or wet ground										
Galeopsis tetrahit L.	–	–	–	–	4	7	5	2	–	Hemp-nettle
Mentha cf. *arvensis* L.	–	–	–	–	–	2	3	4	12	Mint
Cirsium palustre	1	–	–	–	–	1	–	–	–	Marsh Thistle
Carex subgen *Vignea*	15	–	1	–	–	–	–	–	1	Sedge
Carex subgen *Carex*	4	198	1	5	2	2	1	2	3	Sedge
Carex subgen *Carex* (sm)	–	–	–	–	2	3	17	8	6	Sedge
Carex spp.	2	23	2	9	1	7	4	2	4	Sedge
Bryophyta	+	–	+	+	+	+	+	–	–	Mosses/Liverworts
Open disturbed ground										
Chenopodium sp.	1	–	–	2	3	–	–	–	–	Goosefoot
Chenopodium album L.	–	–	–	–	1	2	2	2	–	Fat-hen
Stellaria media L. Villars	–	–	1	7	2	12	47	18	1	Chickweed
Cerastium sp.	–	–	–	4	8	3	–	–	1	Mouse-ears
Polygonum sp.	–	–	–	–	2	1	–	–	–	Knotweed

Table 3 (*continued*)

	Sample number									
	6	42	41	40	25	23	22	21	20	
Persicaria maculosa Gray	–	–	–	2	2	3	3	–	1	Redshank
Polyganum aviculare L.	–	–	–	9	5	3	4	5	4	Knotgrass
Rumex sp.	–	–	–	–	–	6	3	1	–	Dock
Rumex acetocella L.	–	–	–	–	–	–	1	–	–	Sheep's Sorrel
Potentilla anserina L.	–	–	–	–	–	–	–	1	–	Silverweed
Aethusa cynapium L.	–	–	–	–	–	2	–	–	1	Fool's Parsley
Anthemis cotula L.	–	–	–	–	–	1	–	–	–	Stinking Chamomile
Grassland										
Daucus carota L.	–	–	–	–	–	–	–	1	–	Wild Carrot
Lapsana communis L.	–	–	–	–	–	1	–	–	–	Nipplewort
Hypochaeris sp.	–	–	–	–	–	–	–	–	1	Cat's-ear
Leontodon autumnalis L.	–	–	–	–	–	–	–	1	–	Autumn Hawkbit
Poaceae	1	1	–	4	4	9	2	9	14	Grasses
Unclassified										
Malva sp.	–	–	–	–	–	1	–	–	–	Mallow
Brassicaceae	–	–	7	3	2	4	1	1	1	Cabbage family
Luzula sp.	–	–	–	–	–	–	1	1	–	Woodrush
Scrophularia sp.	–	–	–	1	–	–	–	–	–	Figwort
Capsule	–	–	–	1	–	–	–	–	–	
cf. *Sporangia*	–	–	–	+	–	–	–	–	–	
Indet seeds	3	9	2	12	4	9	7	7	6	
Woody bud	4	5	9	31	12	23	1	–	–	
Stem fragments, monocot.	+	+	+	+	–	–	–	+	+	
Bud scales	–	–	+	++	–	–	–	–	–	
Abscission plates	–	–	–	+	–	–	–	–	–	
Leaf fragments	–	+	–	+	–	–	–	–	–	
Woody frags	+	+	++	++	–	–	–	–	–	
cf. Fungal sporocarps	–	–	–	–	+	++	–	–	–	
Bone, small	1	1	–	–	–	–	–	–	–	
Eel bone	4	–	–	–	–	–	–	–	–	
Fish bone	–	1	–	–	–	–	–	–	–	
Caddis larvae cases	–	–	–	–	+	–	–	+	+	
Total	370	938	58	290	147	287	126	121	215	

Towards the northeastern end of this unit a major channel (marked by channel incision B on Figure 3) cuts deep into the gravel (Unit 4) and below this into the underlying till (Unit 1). With abandonment this channel is filled by Unit 5, a horizontally bedded gravel that is subsequently overlain by a cross-bedded gravel, suggesting a degree of lateral migration by the channel. The remains of tree roots in the upper part of Unit 5 may suggest that some soil formation on a subsequently eroded land surface occurred. The events represented by Unit 5 and its channel cut B are probably early Holocene in date, given its stratigraphic position above the Younger Dryas gravels (Unit 4) and that it is subsequently cut by Unit 7, a smaller shallow channel containing lenses of silts and radiocarbon dated to 9610–9170 cal. BC (Beta75198; Table 1). Unit 7 is the location of environmental sampling site β.

Also cutting into the channel fill of Unit 5 are three additional channels (Units 8–10). Unit 8 (Channel D) and Unit 9 (Channel E) have clearly defined basal boundaries and both are filled with gravels that grade upwards into organic-bearing sands and silts, suggesting declining flow conditions through time consistent with channel abandonment. Two radiocarbon dates of 3800–2900 and 2020–1530 cal. BC (Beta74199 and Beta78006; Table 1) and palaeoenvironmental analysis suggests that the channel containing Unit 8 ceased to be active sometime during the Neolithic. Similarly, the channel containing Unit 9 produced two radiocarbon dates of 1880–1450 cal. BC and 250 cal. BC – 250 cal. AD (Beta75197 and Beta78005; Table 1) indicating that it ceased to be active during the Iron Age or the Romano-British periods. Unit 8 is the location of the environmental sampling site χ and Unit 9 is the location of environmental sampling site δ.

Unit 6 was a block of fibrous detrital peat underlying Unit 9. On excavation it was presumed that this peat represented either *in situ* peat development in the base of Unit 9 or was a 'clast' carried to this location when the sands and gravels of Unit 9 were deposited. Certainly, a radiocarbon date of 10 700–9300 cal. BC (Beta75196; Table 1) appeared to support the latter conclusion. Subsequently, it has been suggested that this peat could represent yet a fourth channel in this area of the section that was cut into by the channel containing Unit 9. With no possibility of returning to the section, the actual origin of this deposit must remain speculative. This unit was the location of environmental sampling site ϵ.

Two clay alluvial deposits are present in the upper levels of the section. Unit 11 was a thin band of material covering the terrace deposit. A radiocarbon date of 3970–3710 cal. BC (GRA-1336; Table 1) from a fragment of oak branch from this layer suggests that this material is of Neolithic age. This clay deposit might represent an initial period of erosion and alluvial deposition in the valley linked to local Neolithic clearance and farming. However, the dating of this layer is not secure owing to poor stratigraphic relationships and the possibility that the fragment of oak used as dating material had been redeposited.

A 1.0–1.5 m-deep layer of silt clay alluvium (Unit 12), probably deposited by overbank sedimentation, is continuous across the whole 70 m length of the upper part of the section.

Table 4 The Coleoptera from the sampled deposits at Croft

	5	43	42	41	40	44	27	25	22	20	
Carabidae											
Carabus violaceus L.	–	–	–	–	–	–	–	–	1	–	
C. spp.	–	–	1	–	–	–	1	–	–	–	
Nebria salina Fairm. Lab.	–	–	–	1	1	–	–	–	–	–	
Elaphrus cupreus Duft.	–	–	1	–	1	–	–	–	–	–	ws
Loricera pilicornis (F.)	–	–	–	–	–	–	–	1	–	1	
Clivina fossor (L.)	–	–	–	–	1	–	–	–	1	–	
Dyschirius globosus (Hbst.)	2	–	1	–	–	–	–	–	–	–	
Trechus quadristriatus (Schrk.)	6	–	–	1	2	–	–	–	–	–	
T. quadristriatus or *T. obtusus* Er.	6	–	1	–	–	–	–	–	1	1	
Trechoblemus micros (Hbst.)	–	–	–	–	–	–	–	–	–	1	ws
Bembidion litorale (Ol.)	1	–	–	–	–	–	–	–	–	–	ws
B. bipunctatum (L.)	1	–	–	–	–	–	–	–	–	–	ws
B. schueppeli Dej.	1	–	1	–	–	–	–	–	–		ws
B. doris (Panz.)	–	–	–	1	–	–	–	–	–	–	ws
B. biguttatum (F.)	–	–	1	–	–	–	–	–	–	–	ws
B. guttula (F.)	3	–	1	–	3	1	–	–	–	–	ws
B. spp.	4	–	6	–	3	–	1	–	2	2	
Patrobus septentrionis Dej.	–	–	1	–	1	–	–	–	1	–	ws
P. atrorufus (Ström)	–	–	–	–	–	–	1	–	–	–	ws
Harplus spp.	1	–	–	–	1	–	–	–	1	2	
Stomis pumicatus (Panz.)	–	–	–	1	–	–	–	–	–	–	
Pterostichus strenuus (Panz.)	2	–	–	1	–	–	–	–	1	–	
P. dilgens (Sturm)	–	–	2	–	–	–	–	–	–	–	
P. nigrita (Payk.)	–	–	1	–	–	–	–	–	1	1	ws
P. spp.	–	–	–	–	1	–	–	–	–	1	
Calathus fuscipes (Goeze)	1	–	–	–	–	–	–	–	–	–	
Agonum gracile (Gyll.)	1	–	–	–	–	–	–	–	–	–	ws
A. fuliginosum (Panz.)	–	1	1	–	–	–	–	–	–	–	
A. spp.	2	–	–	–	1	–	–	–	–	–	
Amara spp.	1	–	–	–	–	–	–	–	–	1	
Dromius linearis (Ol.)	2	–	–	–	–	–	–	–	–	–	
Halipidae											
Haliplus spp.	–	–	–	–	1	–	–	–	1	–	a
Dytiscidae											
Hygrotus versicolor (Schall.)	–	–	–	–	–	–	–	–	1	1	a
Hydroporus spp.	1	–	–	–	–	–	–	1	1	1	a
Stictotarsus duodecimpustulatus (F.)	1	–	–	–	1	–	–	–	–	–	aff
Potamonectes depressus (F.)	2	–	–	–	–	–	–	–	–	–	aff
Platambus maculatus (L.)	1	–	–	–	1	–	–	–	–	–	aff
Agabus spp.	3	–	1	–	1	–	–	–	–	1	a
Rhantus spp.	–	–	–	1	–	–	–	–	–	–	a
Colymbetes fuscus (L.)	–	–	–	–	–	–	–	–	–	1	a
Dytiscus spp.	1	–	–	–	–	–	–	–	–	–	a
Gyrinidae											
Gyrinus spp.	1	–	–	–	–	–	–	–	–	–	a
Hydraenidae											
Hydraena riparia Kug.	43	3	33	3	4	–	–	–	3	–	aff
H. nigrita Germ.	–	1	–	–	1	–	–	–	–	–	aff
H. gracilis Germ.	–	–	–	1	–	–	–	–	–	–	aff
H. testacea Curt.	–	–	–	–	6	–	–	–	1	1	a
H. spp.	270	3	33	5	35	4	–	–	5	5	a
Ochthebius bicolon Germ.	–	–	2	1	2	2	–	–	3	3	a
O. minimus (F.)	13	–	4	–	1	–	–	1	2	4	a
O. spp.	40	–	13	5	14	8	7	5	7	2	a
Limnebius spp.	4	–	1	2	7	–	–	1	2	2	a
Helophorus grandis Ill.	–	–	–	–	1	–	–	–	–	–	a
H. spp.	11	–	1	–	7	–	1	2	7	50	a
Hydrophilidae											
Coelostoma orbiculare (F.)	1	–	–	–	–	–	–	–	–	–	a
Sphaeridium lunatum F.	–	–	–	–	–	–	–	–	–	1	df
Cercyon ustulatus (Preyssl.)	–	–	–	–	1	–	–	–	–	–	ws
C. tristis (Ill.)	3	–	–	–	–	–	–	–	–	–	ws
C. convexiusculus Steph.	2	–	–	–	–	–	–	–	–	–	ws
C. spp.	5	3	–	1	2	2	–	–	–	4	
Megasternum boletophagum (Marsh.)	1	1	2	3	1	–	–	–	4	1	
Hydrobius fuscipes (L.)	3	–	–	1	2	–	–	–	–	1	

Table 4 (*continued*)

	5	43	42	41	40	44	27	25	22	20	
Laccobius minutus (L.)	–	–	–	–	–	–	–	–	–	2	ws
L. biguttatus Gerh.	–	–	–	–	–	–	–	–	–	2	ws
L. spp.	1	–	–	–	2	1	–	–	1	4	ws
Enochrus spp.	1	–	–	–	–	–	–	–	–	–	
Histeridae											
Acritus spp.	–	–	1	–	–	–	–	–	–		
Silphidae											
Silphidae Gen. and spp. indet.											
Catopidae											
Catops spp.	1	1	–	–	–	–	–	–	–	–	
Colonidae											
Colon spp.	–	–	–	–	–	–	–	–	–	1	
Liodidae											
?*Liodes* spp.	1	–	–	–	–	–	–	–	–	1	
Clambidae											
Clambus spp.	1	–	1	1	–	–	–	–	–	–	
Scymaenidae											
Scydmaenidae Gen. & spp. indet.	–	–	–	–	1	–	–	–	–	–	
Orthoperidae											
Corylophus cassidoides (Marsh.)	–	–	2	–	–	–	–	–	–	–	
Orthoperus spp.	–	–	–	–	1	–	–	–	–	–	
Ptiliidae											
Ptiliidae Gen. & spp. indet.	–	–	–	1	1	–	–	–	–	–	
Acrotrichis spp.	1	–	–	–	–	–	–	–	–	–	
Staphylindae											
Micropeplus staphylinoides (Marsh.)	–	–	–	–	–	1	–	–	–	–	
Megarthrus spp.	–	–	–	–	1	–	–	–	–	–	
Proteinus spp.	–	–	1	–	–	–	–	–	–	–	
Omalium spp.	1	–	1	1	2	–	1	–	1	–	
Lathrimaeum unicolor (Marsh.)	7	–	1	–	–	–	–	–	–	–	
L. spp.	–	–	–	–	1	–	–	–	1	2	
Olophrum piceum (Gyll.)	1	1	1	–	–	–	–	–	–	–	ws
Lesteva longelytrata (Goeze)	–	–	–	–	–	–	–	–	1	2	ws
L. spp.	2	–	2	1	1	–	–	–	–	–	
Trogophloeus arcuatus (Steph.)	–	–	3	–	–	–	–	–	–	–	ws
T. bilineatus (Steph.)	–	–	–	–	–	–	–	–	1	2	ws
T. rivularis Motsch.	–	–	–	–	–	–	–	–	1	–	ws
T. fuliginosus (Grav.)	–	–	2	1	–	–	–	–	–	–	ws
T. elongatulus Er.	3	–	–	–	–	–	–	–	–	–	ws
T. spp.	5	–	3	–	2	1	–	–	1	–	
Oxytelus sculptus Grav.	–	–	–	–	–	–	–	–	1	–	
O. rugosus (F.)	3	–	3	1	2	1	–	–	–	2	df
O. sculpturatus Grav.	–	–	–	–	–	–	–	1	–	–	df
O. nitidulus Grav.	–	–	–	–	–	–	–	–	1	2	df
Platystethus arenarius (Fourcr.)	–	–	–	–	1	–	–	–	–	1	df
P. cornutus (Grav.)	5	–	–	–	–	–	–	–	1	–	ws
Stenus spp.	–	1	3	–	2	1	1	1	5	1	
Stilicus orbiculatus (Payk.)	–	–	–	–	–	–	1	–	–	–	
Lathrobium spp.	–	–	–	1	1	–	–	–	1	–	
Philonthus spp.	8	–	1	1	5	–	–	–	–	1	
Ocypus spp.	–	–	–	1	1	–	–	–	–	–	
Quedius spp.	1	–	–	–	–	–	–	–	–	–	
Mycetoporus spp.	–	–	1	–	–	–	–	–	–	–	
Tachyporus spp.	–	–	–	–	1	–	–	–	–	–	
Tachinus rufipes (Geer)	–	–	–	–	2	–	–	–	2	–	
T. spp.	–	1	–	–	–	–	–	–	–	–	
Leucoparyphus silphoides (L.)	1	–	–	–	–	–	–	–	–	–	
Aleocharinae Gen. & spp. indet.	13	1	1	1	6	1	1	–	5	10	
Pselaphidae											
Bryaxis spp.	–	–	1	–	1	–	–	–	–	2	
Brachygluta spp.	1	–	1	–	–	–	–	–	–	1	
Cantharidae											
Cantharis spp.	1	–	–	–	1	–	–	–	–	–	
Rhagonycha lignosa (Mull.)	–	–	–	–	1	–	–	–	–	–	t

Table 4 (*continued*)

	5	43	42	41	40	44	27	25	22	20	
Melyridae											
Haplocnemus nigricornis (F.)	–	–	–	–	1	–	–	–	1	–	t
Elateridae											
Agriotes spp.	–	–	1	–	–	1	–	–	–	–	g
Ctenicera pectinicornis (L.)	1	–	–	–	–	–	–	–	–	–	g
Prosternon tessellatum (L.)	–	–	–	1	–	–	–	–	–	–	g
Calambus bipustulatus (L.)	–	–	–	–	–	–	–	–	1	–	g
Denticollis linearis (L.)	–	–	–	1	–	–	–	–	–	–	t
Athous spp.	–	–	–	2	2	1	–	–	1	–	g
Hypnoidus riparius (F.)	1	–	–	–	1	–	–	–	–	–	g
Elateridae Gen. & spp. indet.	–	–	–	–	–	–	1	–	–	–	g
Throscidae											
Throscus dermestoides (L.)	–	–	–	1	–	–	–	–	–	–	
Helodidae											
Helodidae (?Cyphon spp.)	–	–	–	–	2	–	–	–	–	–	ws
Dryopidae											
Helichus substriatus (Müll.)	–	–	–	–	–	1	–	–	–	–	a
Dryops spp.	2	–	1	2	1	–	2	–	5	4	ws
Elmis aenea (Müll.)	5	2	2	2	6	–	–	4	8	1	aff
Esolus parallelepipedus (Müll.)	1	–	4	5	4	–	–	–	–	–	aff
Oulimnius spp.	47	–	5	15	48	9	2	3	50	7	aff
Limnius volckmari (Panz)	–	–	1	5	5	–	1	–	2	1	aff
Riolus cupreus (Müll)	–	1	7	–	–	–	–	–	–	–	aff
Heteroceridae											
Heterocerus spp.											
Byrrhidae											
Byrrhus fasciatus (Forst.)	1	–	–	–	–	–	–	–	–	–	g
Nitidulidae											
Brachypterus urticae (F.)	1	–	–	–	–	–	–	–	–	–	
Meligethes spp.	1	–	–	–	–	–	–	–	–	1	
Rhizophagidae											
Rhizophagus ferrugineus (Payk.)	–	–	–	–	1	–	–	–	–	–	t
Cucujidae											
Silvanus spp.	1	–	–	–	–	–	–	–	–	–	
Cryptophagidae											
Atomaria spp.	1	–	–	–	1	1	–	–	–	2	
Phalacridae											
Olibrus aeneus (F.)	2	–	–	–	–	–	–	–	–	–	ws
Lathridiidae											
Lathridius spp.	1	–	–	–	–	–	–	–	–	2	
Enicmus minutus (Group)	–	–	–	1	–	–	–	–	–	–	
Corticarial corticarina spp.	1	–	1	–	–	–	–	–	1	1	
Colydiidae											
Cerylon ferrugineum Steph.	–	–	1	–	–	–	–	–	–	–	t
Coccinellidae											
Scymnus spp.	2	–	–	–	–	–	–	–	–	–	
Aspidiphoridae											
Aspidiphorus orbiculatus (Gyll.)	–	–	1	–	–	–	–	–	–	–	t
Cisidae											
Cis spp.	–	–	–	–	1	–	–	–	–	–	t
Anobiidae											
Grynobius planus (F.)	–	–	–	–	1	–	–	–	–	–	t
Ochina ptinoides (Marsh.)	–	–	–	–	1	–	–	–	1	–	t
Anobium punctatum (Geer)	–	–	–	1	1	–	–	–	–	–	t
Ptinidae											
Ptinus? fur (L.)	–	–	–	–	–	1	–	–	1	–	
Ptinus subpilosus Sturm	–	–	–	1	–	–	–	–	–	–	t
Mordellidae											
Mordellistena spp.	–	–	1	–	1	–	–	–	–	–	

Table 4 (*continued*)

	5	43	42	41	40	44	27	25	22	20	
Anaspis spp.	–	–	–	–	1	–	–	–	–	–	
Scarabaeidae											
Geotrupes spp.	–	–	–	–	1	–	–	–	1	–	d
Aphodius depressus (Kug.)	–	–	1	–	–	–	–	–	–	–	d
A. contaminatus (Hbst.)	–	–	–	–	–	–	–	–	–	1	d
A. sphacelatus (Panz.)	–	–	–	–	–	–	–	–	–	1	d
A. prodromus (Brahm.)	–	–	–	–	–	–	–	–	2	4	d
A. spp.	1	2	–	2	1	1	–	–	–	–	d
Melolontha melolontha (L.)	1	–	–	–	–	–	–	–	–	–	g
Phyllopertha horticola (L.)	1	–	–	–	3	–	–	–	–	1	g
Cerambycidae											
Leiopus nebulosus (L.)	–	–	–	–	–	–	–	–	1	–	t
Stenostola dubia (Laich.)	–	–	–	–	1	–	–	–	–	–	t
Chrysomelidae											
Donacia? crassipes F.	–	–	1	–	–	–	–	–	–	–	ws
D. impressa Payk.	14	–	1	–	–	–	–	–	–	–	ws
D. vulgaris Zschach	4	–	–	–	–	–	–	–	1	1	ws
D. simplex F.	–	–	1	–	1	–	–	–	3	1	ws
Donacia/ *Plateumaris* spp.	7	1	–	–	–	–	–	1	2	4	ws
Plateumaris sericea (L.)	4	–	1	–	–	–	–	–	–	–	ws
Chrysomela staphylea L.	–	–	–	–	–	–	1	–	–	–	g
Gastroidea viridula (Geer)	–	–	–	–	–	–	–	–	2	–	g
Phaedon? armoraciae (L.)	–	–	–	–	–	–	1	–	–	–	g
P. spp.	–	–	1	–	1	–	–	–	–	–	
Hydrothassa glabra (Hbst.)	1	–	–	–	–	–	–	–	–	–	ws
Melasoma aenea (L.)	–	–	–	1	5	–	–	–	–	–	t
Phyllodecta vitellinae (L.)	1	–	–	–	–	–	–	–	–	–	t
Phyllotreta spp.	–	–	–	–	–	–	–	–	–	1	
Longitarsus spp.	1	–	–	–	2	1	–	–	–	5	
Haltica cf. *oleracea* (L.)	3	–	–	–	–	–	–	–	–	–	g
H. cf. *pusilla* Duft.	1	–	–	–	–	–	–	–	–	–	g
H. spp.	–	–	1	–	–	–	–	–	–	–	
Chalcoides spp.	–	–	1	–	–	–	–	–	–	–	
Chaetocnema concinna (Marsh.)	2	–	–	–	–	–	–	–	–	1	
C. hortensis (Fourcr.)	–	–	–	–	–	–	–	–	2	–	
Bruchidae											
Bruchus/*Bruchidius* spp.	–	–	–	–	–	–	–	–	1	–	g
Scolytidae											
Scolytus intricatus (Ratz.)	–	–	–	–	1	–	–	–	1	1	t
S. ratzeburgi Janson	–	–	–	1	–	–	–	–	–	–	t
Hylesinus oleiperda (F.)	–	–	–	1	–	–	–	–	–	–	t
Hylastinus obscurus (Marsh.)	–	–	1	–	–	–	–	–	–	–	t
Dryocoetes alni (Georg)	–	–	–	–	1	–	–	–	–	–	t
Ernoporuscaucasicus Lindem.	–	–	–	–	1	–	–	–	–	–	t
Curculionidae											
Rhynchites spp.	1	–	–	–	–	–	–	–	–	–	t
Apion craccae (L.)	1	–	1	–	–	–	–	–	–	–	g
A. flavipes (Payk.)	–	–	–	–	–	–	–	–	–	2	g
A. trifolii (L.)	–	–	–	–	–	–	–	–	1	–	g
A. spp.	1	–	4	–	–	–	–	–	2	10	
Phyllobius argentatus (L.)	–	–	–	–	2	–	–	–	–	–	t
P. pyri (L.)	–	–	1	–	–	–	–	–	–	–	t
P. spp.	–	–	2	4	1	–	–	–	–	–	
Polydrusus Germ.	1	–	–	–	–	–	–	–	1	–	
Strophosoma melanogrammum (Forst.)	–	–	1	–	1	1	–	–	–	1	
S. spp.	–	–	–	–	–	–	–	–	–	–	
Barynotus obscurus (F.)	–	–	–	–	–	–	–	–	3	–	g
Sitona spp.	1	–	1	–	–	–	–	–	–	–	g
?*Cleonis piger* (Scop.)	–	–	1	–	–	–	–	–	–	–	
Phloeophagus lignarius (Marsh.)	–	–	–	1	–	–	–	–	–	–	t
Bagous spp.	–	–	–	–	4	–	–	–	3	–	ws
Tanysphyrus lemnae (Payk)	1	–	3	–	–	–	–	–	–	–	ws
Notaris scirpi (F.)	3	–	–	–	–	–	–	–	–	–	ws
N. acridulus (L.)	–	–	–	–	–	–	–	–	1	1	ws
N. aethiops (F.)	–	1	–	–	–	–	–	–	–	–	ws
Thryogenes nereis (Payk.)	3	–	–	–	–	–	–	–	–	3	ws
T. scirrhosus (Gyll.)	–	–	2	–	–	–	–	–	–	–	ws

Table 4 (*continued*)

	5	43	42	41	40	44	27	25	22	20	
Leiosoma deflexum (Panz.)	–	–	–	1	2	–	–	–	2	–	
Hypera plantaginis (Geer)	1	–	1	–	–	–	–	–	–	–	g
Limnobaris pilistriata (Steph.)	–	–	2	–	–	–	–	–	–	–	ws
Eubrychius velutus (Beck)	–	–	–	–	–	–	–	–	–	3	ws
Rhinoncus castor (F.)	–	–	–	1	–	–	–	–	–	–	g
Ceutorhynchus spp.	3	–	2	1	1	1	–	–	1	1	
Cidnorhinus quadrimaculatus (L.)	–	–	–	–	–	–	–	–	1	–	
Orobitis cyaneus (L.)	–	–	1	–	–	–	–	–	–	–	
Gymnetron spp.	–	–	1	–	–	–	–	–	–	–	g
Rhynchaenus quercus (L.)	–	–	–	–	–	–	1	–	–	–	t
R. testaceus (Müll)	–	–	–	–	2	–	–	–	–	–	t
R. stigma (Germ.)	–	–	3	–	–	–	–	–	–	–	t
R. spp.	1	–	–	–	1	–	–	–	–	–	t

a, aquatic species; aff, aquatic, fast flowing waters; ws, waterside species either from muddy banksides or from waterside vegetation; df, species associated with dung and foul matter; d, species associated with dung; g, species associated with grassland and pasture; t, species either associated with trees or with woodland in general.

Species of biological importance

Ernoporus caucasicus. This species of bark beetle (Scolytidae) is very rare in Britain today. It is listed in Hyman and Parsons (1992) as endangered (Red Data Book Status 1). Today, the species is limited to a few trees at Moccas Park, Herefordshire, and isolated records from a few other locations in the Midlands. However, there are now a relatively large number of archaeological records for this species from contexts dating to before 3000 BC (Kelly and Osborne, 1965; Buckland, 1979; Girling, 1984; Robinson, 1993) in the British Lowlands. This species has also been recovered from the earlier part of the sequence at Kirby Muxloe (Greenwood and Smith, 2005) and at Langford, Nottinghamshire on the Trent (Howard *et al.*, 1999). Robinson (1993) has suggested that the species is a 'relict' left from the former dominance of lime (*Tilia* sp.) woods over much of Southern England and the Midlands.

Scolytus ratzeburgi. This species of bark beetle *now* seems to be restricted to a limited area in the highlands of Scotland (Hymen and Parsons, 1992). It would appear to have had a more southern distribution in the past. It has been found in sediments from West Bromwich, Staffordshire dated to 9540 BP (Osborne, 1979) from the Bronze Age peats at Thorne Moor, Yorkshire (Buckland, 1979). Buckland and Dinnin (1993) have suggested that its current restricted distribution is probably due to habitat reduction rather than climatic change.

At least two palaeosols are present in this unit, suggesting that phases of alluviation were separated by periods of non-deposition and soil development. A mid-Iron Age or later date for the initiation of this alluviation is suggested, since this covers the Iron Age–Romano British channel Unit 9. This date for the initiation of large-scale late Holocene alluviation is broadly in line with that suggested for the adjacent Rivers Soar and Trent (Brown *et al.*, 1994, Knight and Howard, 1995, 2005).

The palaeoenvironmental evidence from trench F

The palaeoenvironmental analyses from the five sampling sites are presented in chronological order.

Sample site α: Allerød channel fill (Unit 3)

A single monolith tin was taken from this unit. Only the top 4–6 cm had enough pollen to be interpretable. The result is shown in Table 2. Despite the low concentration, and limited diversity of types, the spectrum clearly indicates a Lateglacial-type environment. Birch (*Betula*) and pine (*Pinus*) were dominant, with slight traces of hazel (*Corylus*), stone pine (*Picea*) and larch (*Larix*). This is an arboreal fauna that is typical of boreal forests. Also present were classic Lateglacial indicators such as the rock roses (*Helianthemum*) and the saxifrages (Saxifragaceae). Given its position in the profile it is almost certain to have been deposited during the Lateglacial, probably at the end of the Allerød Interstadial *c.* 11 500–11 000 yr BP. This would suggest that the gravel terrace (Unit 4) was of Younger Dryas (11 000–10 000 BP) age.

Sample site ε: early Holocene peat (Unit 6)

This block of fibrous peat (Unit 6) was initially assumed to be a clast of material derived from an earlier channel that had been redeposited in channel cut E. Primarily, the evidence for this came from the early date of this fibrous peat (a date on sediment from the base of the peat gave a result of 10 700–9300 cal. BC (Beta7519: Table 1)). Subsequently, the possibility that this peat may represent the remains of an *in situ* channel has been raised. Unfortunately, resolving the true stratigraphic relationship between these two units from the written archive has proven difficult and its exact origin must remain spec-

Table 5 The proportions for ecological groupings of Coleoptera from Croft Quarry, Leicestershire

	5	44	43	42	41	40	27	25	22	20
% aquatic	71.3	43.9	41.6	54.5	51.1	57.7	50.0	68.0	54.4	43.2
% fast flowing /aquatic	22.5	39.1	70.0	50.4	68.8	48.2	23.1	41.1	67.7	11.2
% waterside	5.9	4.8	12.5	11.2	4.5	5.5	11.5	5.8	12.8	16.7
% dung + foul / terrestrial	2.8	12.5	27.2	5.9	7.6	5.4	0.0	4.7	2.3	6.4
% grassland/ terrestrial	8.4	12.5	0.0	13.4	10.2	7.6	30.0	0.0	16.1	4.05
% woodland / terrestrial	1.4	0.0	0.0	10.4	20.5	20.6	10.0	0.0	7.1	1.35
No. of individuals	624	24	196	88	251	41	26	21	171	185

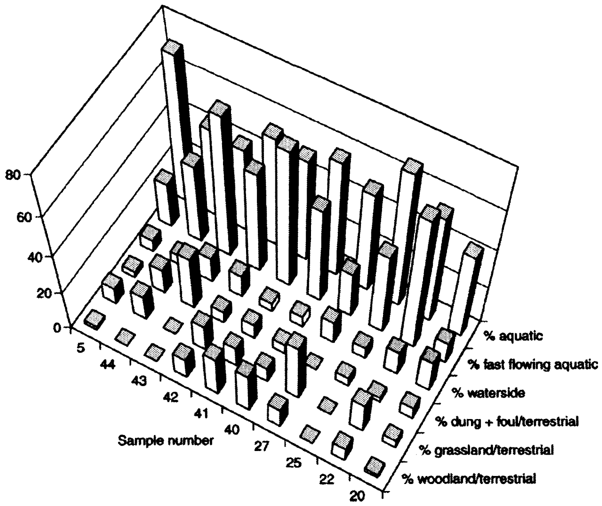

Figure 6 The proportions for ecological groupings of Coleoptera from Croft Quarry, Leicestershire

ulative. Despite this difficulty, analysis of this unit is included here as material of this date is relatively rare in the Trent/Soar catchment.

Four pollen sub-samples were taken at 0.06 m intervals (forming sample 3: Figure 4). Beetle sample 5 and plant macrofossil sample 6 also came from this deposit. Herbaceous pollen taxa dominate the spectra, with grasses (Poaceae) and sedges (Cyperaceae) most abundant. Over time there appears to be decline in grasses (from 53% total land pollen (TLP) down to 20%) with a corresponding rise in sedges (from 19% up to 25–50% TLP). Camomile type (*Anthemis* type) disappears (from 7% down to nearly 0%) but there is a progressive increase in meadowsweet (*Filipendula*) (rising to 28% TLP) and cowslip (*Primula veris*) type (4% TLP).

This expansion of floodplain grassland probably reflects the amelioration in climate at the start of the Holocene. To a limited extent, the insects also indicate this ground cover. The *Melolontha melolontha*, *Phyllopertha horticola* and *Byrrhus fascitus* are all associated with the roots of grasses (Jessop, 1986; Koch, 1989).

Total tree pollen representation is, throughout, very low. Birch pollen, probably dwarf birch (*Betula nana* L.), represents only 5–10% of the pollen sum. Correspondingly, only a small number of tree buds, possibly including birch, were recovered. The only arboreal insect present is *Phyllodecta vitellinae*, which is associated with willow (*Salix* spp.) (Koch, 1992).

The peat appears to have derived from reed swamp. It contained abundant remains of common club rush (*Schoenoplectus lacustris*) and remains of the beetle *Donacia impressa*, which feeds on it. Sedges (*Carex* spp.) and bulrushes (*Typha* spp.) were also recovered from the plant remains and the weevil *Thryogenes nereisis* indicates that spike rush (*Eleocharis palustris*) was present. Four beetle species recovered (*Donacia vulgaris, D. simplex*, *Platuemaris sericea* and *Notaris scirpi*), are also associated with sedges and rushes (Koch, 1992).

Both the plant and insect remains provide evidence for areas of still and shallow water amongst the reed bed. The plant macrofossils included common water plantain (*Alisma plantago-aquatica*), marestail (*Hippuris vulgaris*), stonewort (*Chara* sp.) and watercrowfoot (*Ranunculus* subgenus *Batrachium*). Some of the water beetles present, such as *Coelostoma orbiculare*, *Cercyon* and *Laccobius* species and *Ocththebius minimus*, occur in such aquatic environments. Cotton grass (*Eriophorum* sp.) and the bog moss (*Sphagnum* sp.) suggest the presence of boggy and acidic conditions in the vicinity.

Conversely, 22.5% (Table 5, Figure 6) of the water beetles present are from a different type of fluvial environment. The elmid 'riffle beetles', such as *Elmis aenea*, *Esolus parrellelepipedus* and the various *Oulimnius* and the dytiscids *Stictotarsus duodecimpustulatus*, *Potamonectes depressus* and *Platambus maculatus* are all associated with fast-flowing waters and sand or gravel channel beds (Balfour-Browne, 1953; Holland, 1972; Hansen, 1987). Some Carabidae beetles, noticeably *Bembidion litorale*, are also similarly associated with areas of detrital sand on sparsely vegetated riverbanks beside running waters (Lindroth, 1974). It is probable that these species were washed into the reed bed from elsewhere on the floodplain, perhaps during times of flood, or are intrusions from periods of gravel deposition and reworking represented by the material above and below this peat unit.

Sample site β: early Holocene peat (Unit 7)

This sample location was from the early Holocene sand-silt-clay fill of channel C. A sediment sample yielded a radiocarbon date of 9610–9170 cal. BC (Beta74198; Table 1). A single sample (Sample 32: Figure 4) was taken for pollen analysis. The pollen spectrum contained 40% Poaceae and 33% Cyperaceae, with additional representation of birch (*Betula*), pine (*Pinus*), buttercups (Ranunculaceae) and great burnet (*Sanguisorba officinalis*) (>5% each). Bulrush (*Typha*) and bur-reed (*Sparganium*) are well represented at 51% of TLP + aquatics. This suggests that a grass-sedge community, similar to that from sample site ε, persisted at Croft until at least this date.

Sample site χ: Neolithic channel cut (Unit 8)

The fill of this shallow palaeochannel consisted of laminated fluvial gravels that graded upwards into a sand containing organic material. Sediment from the base of the fill was dated to 3800–2900 cal. BC (Beta74199; Table 1) and a branch of ash wood from the upper fill to 2020–1530 cal. BC (Beta78006; Table 1). Two samples (40 and 42) were collected for pollen analysis in this channel. Figure 4 shows the pollen spectra. Four samples for plant macrofossils and insect remains (samples 40–43) were also taken. The results of this analysis are shown in Tables 3 and 4.

The pollen assemblage from the lower level of the organic silts (sample 42) indicates the existence of woodland dominated by common hazel (*Corylus avellana*) or bog myrtle (*Myrica gale* – *c.* 30%), birch (probably silver birch or downy birch *B. pendula*/*pubescens* – *c*. 30%) and some willow (*Salix* sp.). Nutshells of common hazel were also particularly abundant in the plant macrofossils. Clearly, much of the damp grassland and tall-herb meadow that had characterized the Lateglacial (see sample sites β and ε above) had been replaced by woodland of hazel/myrtle, birch and willow. It is likely that willows favoured the damp soils of the floodplain, where birches, and perhaps bog myrtle, may also have competed successfully. Hazel may also have grown on the floodplain in this period (A.G. Brown, personal communication, 2002) and would also have been present on the drier, more fertile soils of the valley slopes.

The pollen from the upper level of this sedimentary unit (sample 40) indicates that alder carr had started to dominate the floodplain vegetation by this time, since alder accounts for 50% of the arboreal pollen present. Both seeds and buds of alder are abundant in the plant macrofossil remains and alder is also indicated from the insect fauna from this level. The beetles *Melasoma aenae*, *Dryocetes alni* and *Rhynchaenus testaceus*, are all associated with this tree. The remaining 50% of the arboreal pollen in the upper level comprises equal

Table 6 Dating, description and interpretations of main Units recorded in trench F

Periods	Unit	Date	Dating evidence	Environmental sampling site	Sediment	Summary interpretation
GLACIAL DEPOSITS	1	? Anglian glaciation (400 ka BP)	Position in stratigraphy, visual comparison to other deposits in the area		Dark grey clay flecked with chalk fragments	Superficially resembles the Oadby till (*sensu* Bridge *et al*., 1998). This material potentially underlies the whole of the valley at this depth
	2	Devensian (> 13 000 ka BP)	Position in stratigraphy. Find of worked Palaeolithic flint		Homogenous sandy clay containing lenticular structures	Interpreted in the field as the remains of a degraded soil that formed on the Anglian till. Lenticular structures suggest that this soil formed under periglaical conditions. Preliminary studies of the soil micromorphology that this palaeosoil subsequently became waterlogged
	3	Allerød (Windermere) Interstadial (13 000–11 000 BP).	Position in stratigraphy. Pollen flora	α	Two areas of black, stone free, organic, sandy silts sited in small channels marked by a clear lower erosion boundary, where they have cut into Unit 2	Remains of two small channels that had cut into Unit 2 during the Alleröd. Both have been heavily truncated by erosion in later periods. Both channels seemed to have formed under slow water conditions
	4	Stratigraphy suggests Younger Dryas (Loch Lomond) Stadial (*c*. 11 000–10 000 BP).	Position in stratigraphy		Dominant material in trench. Massively and horizontally bedded coarse sands and gravels up to 2 m in thickness	Resembles a classic glacial or early Holocene terrace deposit. It seals the apparently Allerød interstadial deposit Unit 3 and, at its northeastern end, is subsequently cut by the major early Holocene channel B. It probably represents deposition in a braided outwash river system.
EARLY POST GLACIAL/ MESOLITHIC CHANNEL ACTIVITY	5	Probably early Holocene since truncated by the reactivation of channel C and D.	Position in stratigraphy (cut by reactivation of channels C and D)		The lower levels layers of horizontally bedded sands and gravels. Southeastern end displays cross-bedding slopping down to the northeast. Upper levels consist of stone free bands of sandy silts penetrated by horizontal network of roots	Unit 5 probably represents the deposition of material in channel under initially turbulent river conditions shortly after the initial activity of channel B with the upper silty sand layer representing deposition of finer material as fluvial conditions slowed or later over bank sedimentation. The cross-bedded nature of the silt deposits in the southwestern end of this unit suggests some lateral migration of this channel. The tree roots in the upper portion of these deposits suggest that a stable and long-lived ground surface developed in this area. The majority of the depth of this ground surface appears to have been removed by subsequent channel activity
	6	10 700–9300 cal. BC	Radiocarbon date supported by environmental evidence	ε	An isolated block of a fibrous, dark brown, stone free organic peat in the base of channel cut E.	This deposit appears to be a detrital fresh water peat. It may be either: (1) a transported clast: (2) the remains of an *in situ* peat from a back channel which is subsequently cut by channel E. Unfortunately the confused nature of the material in the base of this channel has meant that this relationship is not stratagraphically clear

Table 6 (*Continued*)

Periods	Unit	Date	Dating evidence	Environmental sampling site	Sediment	Summary interpretation
	7	9610–9170 cal. BC	Radiocarbon date supported by pollen	β	Clear lower re-activation boundary. The lower fills of the channel consist of a clast bearing grey silt. The upper fills consist of organic black silt.	A small channel which cut into unit 5 and subsequently filled with silts
MID AND LATER HOLOCENE (NEOLITHIC, BRONZE AND IRON AGE CHANNEL BEHAVIOUR	8	3800–2900 cal. BC to 2020–1530 cal. BC (*terminus post quem*)	Radiocarbon date supported by environmental evidence	χ	A channel defined by cut D. The lower levels massively bedded gravels grading upwards into sands and silts. Sands contain clasts or blackened by large amounts of organic material	A reactivation channel initially formed under turbulent conditions with the organic containing sands and silts being deposited as fluvial energy declined
	9	1880 cal. BC to 1450 cal. BC and 250 cal. BC to 350 cal. AD BC (*terminus post quem)*	Radiocarbon date supported by environmental evidence. The lower gravels contained an auroch metapodial bone	δ	A channel defined by cut E. The lower levels massively bedded gravels grading upwards into sands and silts. Sands contain clasts or blackened by large amounts of organic material	A reactivation channel cutting into underlying material. Formed initially under turbulent conditions with the organic containing sands and silts being deposited as fluvial energy declined
	10	1130–800 cal. BC 1010–820 cal. BC	Radiocarbon dates		A poorly defined gravel and peat clast filled channel	The size of the gravels present suggest high energy conditions
LATER (?NEOLITHIC AND IRON AGE) ALLUVIATION	11	3970–3710 cal. BC	Radiocarbon date		A harsh red brown, clay that becomes progressively more sandy and stone laden laterally at the northeastern end of the trench	It is tempting to see this deposit as an depositional event happening with the earliest clearance of the catchment for agriculture during the Neolithic. However, the exact stratigraphic and temporal relationship of this burning event and underlying Unit 5 is unclear. Moreover, it can be argued that the charred material that provided the radiocarbon date could be re-deposited into much younger material
	12	Post 350 cal. BC			A layer of often-gleyed clay stained red by iron precipitation. It is between 1.0 and 1.5 m thick and is traceable across the whole length of the trench. Between *c.* 20 and 24 m from the southwestern end of the trench a soil developed on the lower band of this clay suggesting that there may have been periods of stability during its formation	Valley-wide alluviation. The exact timing of the onset of valley-wide alluviation is not clear. However, this unit spans Iron Age/Roman channel E (Unit 9). This alluviation must have started at some point after 350 BC. This is a similar period to that suggested for the initiation of the major phase of alluviation in the majority of the River Trent (Knight and Howard, 1995)

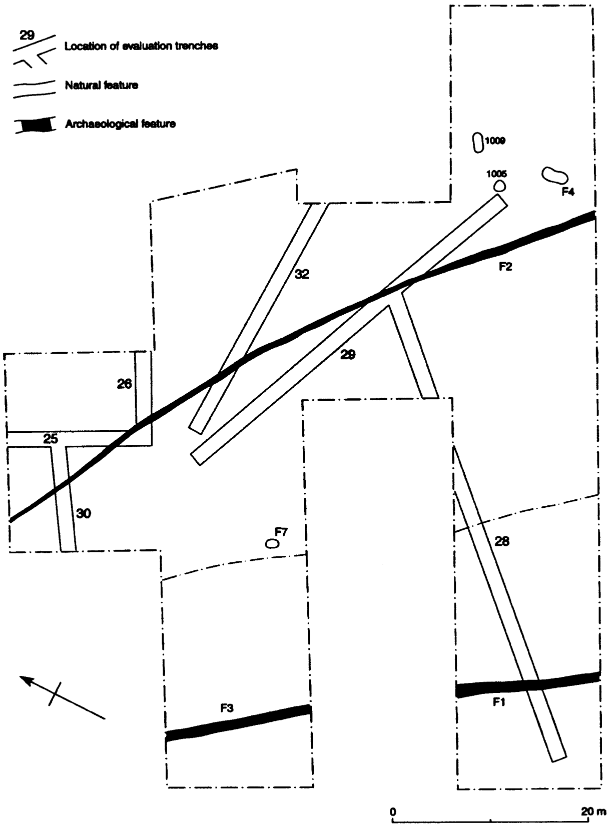

Figure 7 Plan of trench A

amounts of lime (*Tilia* sp.), oak (*Quercus* sp.) and hazel. These taxa probably occupied the nearby valley sides, perhaps with lime as the dominant tree species (Greig, 1982). The limited presence of elm (*Ulmus*) pollen is consistent with the post-elm decline radiocarbon date. This mixed woodland is also represented in the plant macrofossils from this layer. Lime fruits were recovered, one of which was possibly small-leafed lime (*Tilia cordata*), along with birch seeds and an immature acorn. Dog's-mercury (*Mercurialis perennis*) and bugle (*Ajuga reptans*) also indicate woodland.

The insects also indicate the presence of this valleyside woodland. A range of dead-wood feeders including *Rhagonycha lignosa*, *Cercylon ferrugineum*, *Denticollis linearis*, *Aspidiphorus orbiculatus*, *Haplocnemus nigricornis*, *Rhizophagus ferrugineus*, *Phloeophagus lignarius* and the Anobiidae and Ptinidae are present. More specific indicators are Ochina ptinoides that feeds on ivy (*Hedera helix*), *Scolytus ratzburgi*, which feeds on birch, *Hylesinus oleiperda* that feeds on pine, and two lime feeders, *Ernoporus caucasicus* and *Stenostola dubia*. Given the limited flight range of some of these species, and the small scale of this valley, it is possible that this valley-side forest was close to hand. Woodland species (including those associated with alder) account for 20% of the terrestrial fauna present (Table 5 and Figure 6). Robinson (1981) argues that proportions of woodland taxa at 20% or higher are indicative of the presence of relatively closed mature woodland.

However, there is also evidence for areas of more open ground or clearings. Plants of open, damp ground include ragged robin (*Lychnis flos-cuculi*), blinks (*Montia fontana* ssp. *fontana*) and gypsywort (*Lycopus europaeus*). Several of the insects present also feed on open-ground species of plants. Amongst these are *Apion craccae* (associated with vetches), *Sitona* spp., *Hypera plantaginus* (both on clover), *Cleonis piger* (thistles), *Orbitis cyaneus* (various species of violets) and *Gymnetron* spp. (plantains). The pollen spectra also include meadow grasses, sedges (*Carex* spp.) meadowsweets (*Filipendula* sp.), ribwort plantain (*Plantago lanceolata*) and sheep's sorrel (*Rumex acetosella* type). The insect *Hylastinus obscurus* indicates that gorse (*Ulex europeaus*) or broom (*Cytisus scoparius*) was present. There are also several species of insect present that may indicate limited grazing. This includes relatively small numbers of *Aphodius* dung beetles and three individuals of *Phyllopertha horticola*, which lives in turf in old meadows and grasslands. This result indicates that small areas of the woodland may have been opened out by this period. However, whether this result is due to human activity (i.e., Robinson, 2000) or to the development of natural clearings is not certain (i.e., Buckland and Edwards, 1984).

Within the river system there is clear evidence for the presence of beds of emergent vegetation. The plant remains from this environment are dominated by club-rush (*Schoenoplectus* spp.), with sedges (*Carex* spp.) and bur-reed (*Sparganium* sp.). Many of the species of reed beetle (*Donacia*) and some of the weevils recovered feed on these plants. Areas of still or stagnant water are also indicated by the insects. In

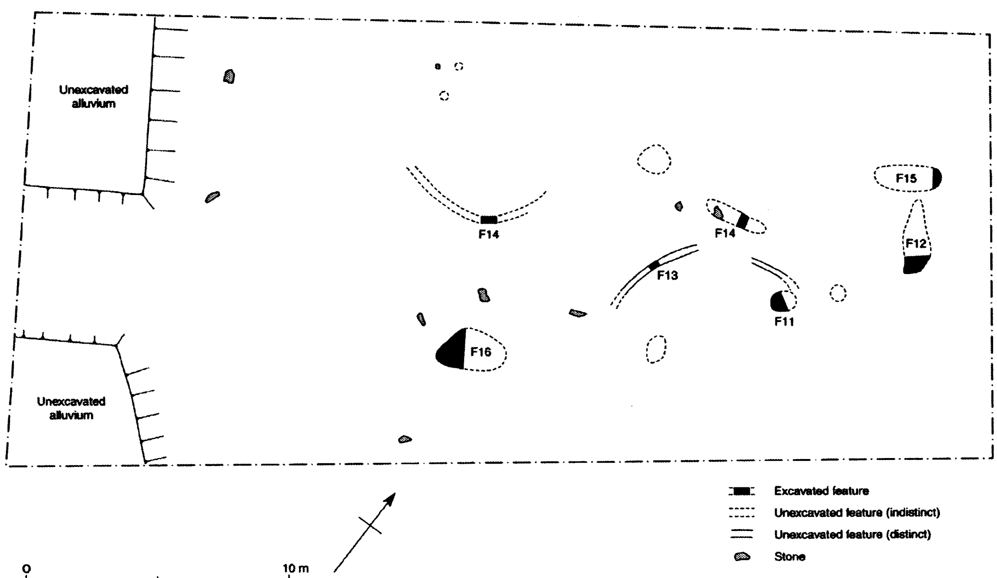

Figure 8 Plan of trench H

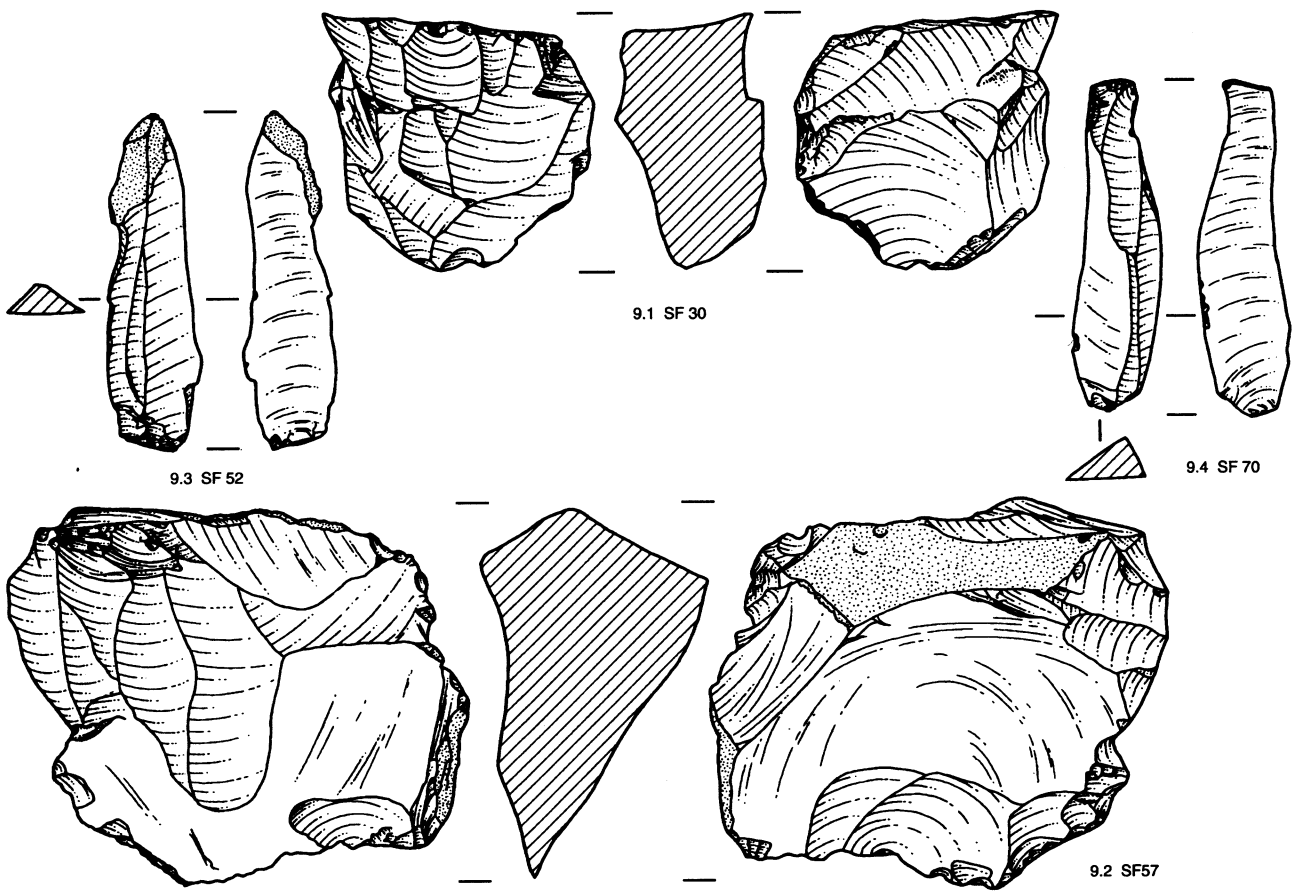

Figure 9 The flint from trench H

addition to the species described above (sample site ε) *Tanysphyrus lemnae* and *Donacia crassipes*, the former associated with duckweeds (*Lemna* spp.) and the latter with white water lily (*Nymphaea alba*), are present. Again the relatively high numbers of the elmid and dytiscid species associated with fast-flowing water and gravely bottoms suggests that higher energy aquatic environments also existed.

Sample Site δ: Bronze Age/Iron Age channel cut E (Unit 9)

The sedimentary sequence at this sampling site is similar to that described for Unit 8. A radiocarbon date of 1890–1500 cal. BC (Beta75197; Table 1) from a fragment of hazel from the base of this deposit and one of 350 cal. BC to 350 cal. AD (Beta78005; Table 1) from sediment in the upper layers indicate a Late Bronze Age/Iron Age date for the abandonment and infilling of this channel. A sampling interval of 5 mm, from a series of vertical monolith tins, was used for pollen analysis. Adjacent bulk samples were collected for beetle and plant analysis (samples 20–23). The results for the pollen are shown in Figure 5, the plant macrofossils in Table 3 and the insects in Tables 4 and 5 and Figure 6.

Three broad pollen zones were recognized from this deposit (CRA-1 to CRA-3). The results suggest that there is declining tree cover throughout the period. At the base of the deposit (zone CRA-1) 90% of the pollen assemblage is comprised of deciduous tree pollen, mostly alder (50–55%), but with oak, hazel and lime present in small amounts (10–20%). The forest

Table 7 Composition of the ULAS 1992 assemblage by trench

Trench no.	Flake/chunk	Blade	Core	Core/ hammer	Scraper	Other retouched	Total number	Total weight (g)
2*	1/-	–	1	–	–	–	2	12
3*	11/3	1	2	–	–	–	17	124
4*	9/1	7	2	–	–	–	19	115
12	8/-	1	–	1	–	1	11	113
15	1/-	–	–	–	–	–	1	9
16*	5/1	–	–	–	–	–	6	80
17	2/-	–	2	–	1	1	6	152
18	1/-	–	–	–	–	–	1	<1
23	-	–	–	1	–	–	1	425
28	1/-	–	–	–	–	–	1	13
Totals	39/5	9	7	2	1	2	65	1043

*Includes Mesolithic material.

Table 8 Composition of the BUFAU 1996 assemblage by trench

Trench	Flake/chunk	Blade	Scraper	Other retouched	Total number	Total weight (g)
A*	2/-	–	1	–	3	12
D	1/-	–	–	1	2	18
F	1/-	–	–	1	2	12
H*	9/1	2	–	–	12	25
Totals:	13/1	2	1	2	19	67

*Includes potentially Mesolithic material.

composition initially, therefore, seems similar to that of the Neolithic channel cut D. However, zone CRA-2 sees significant alteration in forest composition. Alder appears to initially rise to 70% of the TLP in the middle of pollen zone CRA-2, suggesting that it becomes dominant in the floodplain. This raised presence for alder is also suggested by its dominance of the plant macrofossils from this level and a matching decline in the number and variety of the other tree species recovered (samples 22 and 23: Table 6). The pollen also indicates a continued decline in forest species, probably from the valley-sides rather than the floodplain, such as oak and hazel to 5–10% and lime to 2–5%. The latter echoes the lime decline recorded in pollen diagrams throughout England, and generally attributed to Bronze Age human activity (Greig, 1982). By the top of pollen zone CRA-3 this decline in woodland or forest cover appears to become particularly strong, with a dramatic decline in total tree and shrub frequencies, especially alder which is reduced to only 6%. The plants and insect remains recovered from samples 20 and 21 associated with this level also show a dramatic decline in species associated with true forest or woodland at this time, particularly when compared with those from the Neolithic channel cut D (Table 5 and Figure 6).

There is clear evidence throughout the three pollen zones for an increasing occurrence of pasture and cultivated ground. Pasture is suggested by increases in grass pollen, which rises to 20–40% TLP, and ribwort plantain pollen (*Plantago lanceolata*), rising to 5–15%, by the end of zone CRA-3. This is echoed to a limited extent by the results from the insects (ecological group g in Table 5 and Figure 6). Present are *Chrysomela staphylea* and *Gastroidea viridula*, which feed on docks (*Rumex* spp.), are present, as well as a species of *Apion* that feeds on clovers (*Trifolium* sp.), and *Phyllopertha horticol, a,* which feeds on the roots of grass. There is also a small fauna of *Aphodius* dung beetles. However, this grouping is present in relatively small proportions compared with other similarly dated results (i.e., Robinson, 1979, 1981, 1983, 1993). This may suggest that this pasture environment was not directly adjacent to the channel itself.

An increase in arable land is also suggested by the slight traces of cereal pollen in zone CRA-1 and 2 (*Avena*/*Triticum* type), which rises to 1–2% TLP in zone CRA-3. In addition, there is also a rising representation of fern spores (10–20%). Perhaps more indicative is the dramatic increase in species that are indicators of cultivated or disturbed ground recovered from the plant macrofossils. These are present in the earlier samples but become dominant in the later deposits. This includes nitrophilous plants such as nettle (*Urtica dioica*) and plants of open, disturbed or arable land such as goosefoots (*Chenopodium* spp.) knotweeds (*Polygonum* spp.), fat-hen (*Chenopodium album*), chickweed (*Stellaria* spp.), dock (*Rumex* spp.), meadowsweet (*Filipendula* sp.), fools parsley (*Aethusa cynapium*) and silverweed (*Potentilla anserina*).

Both radiocarbon dates from this channel fill must be regarded with some doubt; since they are derived from material that is certainly re-deposited. However, the cutting of the earlier Neolithic channel D by channel E does at least provides a *terminus post quem* for its formation. If the Bronze Age date for pollen zone CRA-1 is valid, the biological remains apparently indicate that some agricultural settlement, possibly quite small scale, existed within what must have still been a well-wooded landscape dominated by alder carr in the floodplain. By the late Iron Age it is clear that the landscape was essentially cleared of woodland and that arable and pastureland had expanded not only in extent, but also probably onto the floodplain itself.

The archaeology and sedimentology of the northern area (trench A)

The gravel at the base of this trench compares visually to the glacial terrace seen in trench F and a similar glacial/early Holocene date is tentatively suggested. Two silt-sand filled linear ditch features (Figure 7: F1/3 and F2) were orientated approximately southeast to northwest. These drained towards the prehistoric Thurlaston Brook. Both ditches were up to 1 m wide and between 0.25 and 0.4 m deep with a U-shaped profile. The northern ditch (F2) was slightly curved. These also cut through at least 0.2 m of the overlying silt sand alluvium and, therefore, postdate the initial deposition of alluvium in this valley. Both features were then covered with a further 0.5 m of silt clay alluvium, including a developed soil horizon. It is suggested that these ditches were dug between the two phases of alluviation. Finally, a prolonged phase of soil development occurred between another two phases of alluvial deposition.

The only finds from this area were three flint flakes and a sherd of undiagnostic, abraded pottery (which could be Iron Age or Romano-British in date) from the southern feature (F1/F3), and a single struck flake from the northern feature (F2).

Although it proved difficult to directly date these features, work in trench F suggested that the initiation and deposition of the alluviation in this valley occurred from the Iron Age and the Romano-British periods. By extension, these features probably date from this period. Traces of mediaeval ridge and furrow visible on the surface were also observed in the upper levels of the section.

The archaeology and sedimentology of the southern area (trench H)

Trench H was excavated to help define the nature and extent of the flint scatter and features that had been recorded in this area during the evaluation. This trench was approximately 40 × 20 m^2 (Figure 8); however, because of flooding it was only possible to undertake a limited programme of excavation and recording.

During excavation a number of pits (F11, F12, F14–F16) and the traces of two curvilinear features (F10 and F13) were recorded and partially excavated (Figure 8). All features contained charcoal flecks and three of the pit features contained struck flint flakes. These flints, in addition to a larger flint assemblage recovered from this area during the evaluation (Cooper, 1993), are of Mesolithic date and are discussed by Bevan below. A single radiocarbon date of 4550–4350 cal. BC (Lab. No. GrA-1364; Table 1) from a branch of *Prunus* wood appears to confirm a Mesolithic date for these features.

Both curvilinear features appear to have formed complete rings 6.5 m and 7 m across. They may represent eavesdrip gullies associated with roundhouses (Hughes and Roseff, 1996).Unfortunately, these features could not be directly dated, but on typological grounds are probably prehistoric (Hughes and Roseff, 1996). Given the problems encountered on site, and the rarity of such features in the archaeological record, this area of the site has been preserved *in situ*.

A dark clay layer 0.1 m in depth sealed both the gravels and these features. This layer was interpreted as a buried soil developed on a fine-textured silt clay alluvium. A radiocarbon date on a fragment of hazel wood from this layer resulted in a date of 1270–990 cal. BC (Lab. No. Gra-1394; Table 1) suggesting that this ground surface developed during or after the late Bronze Age. This is covered by approximately 1 m of fine silt clay alluvium, probably also related to the late first millennium BC alluviation recorded in trench F.

Mesolithic to Bronze Age struck flint from trench H (by Lynne Bevan)

A small *in situ* riverine site containing struck flint, such as the one at Croft Quarry, is very rare in the region (Hughes and Roseff, 1996) and in the Midlands in general (Bevan, 1996). Study of such sites increases our knowledge of this poorly represented period that is often viewed from a technological rather than a social perspective (Bevan and Moore, 2003).

The flint was examined with the aid of an × 10 magnifying glass, recorded and weighed. Only a small selection of the flint was illustrated (Figure 9.1–9.4), non-illustrated items that are mentioned in the following discussion will include small find (prefix SF) and context numbers.

The total assemblage of human-worked flint comprised 84 items, weighing 1.11 kg, the majority of which (65 items) was recovered from the evaluation conducted by University of Leicester Archaeology Service (ULAS) in 1992. The composition of the ULAS assemblage is summarized in Table 7. The remainder of the assemblage, 19 flints weighing 67 g, was recovered during the excavation conducted by the Birmingham University Field Archaeology Unit. This small assemblage is summarized in Table 8. In the following discussion these two collections have been treated as a single assemblage for purposes of description and analysis.

The raw material used was a generally translucent flint, beige and brown in colour, sometimes yellowish brown or with a greyish, speckled appearance. It tended to be of a good quality, although a few of the fragments appeared more opaque and cherty, with a coarser, 'soapy' texture. Most pieces had retained traces of a thin, compacted cortex indicative of a secondary, pebble source, most probably local river gravels.

The earliest activity on the site dates to the later Mesolithic, the focus of which appears to have been located towards the south of the site, in the vicinity of trenches 2–4. The date is based on five typologically later Mesolithic blade cores from this location (i.e., SF 30, Figure 9.1). These were often multiplatformed (SF 47, SF 59) showed evidence of detachment of narrow blades (SF 47, SF 35) or had been re-used as scrapers (SF 57, Figure 9.2). In addition one was burnt (SF 47). Seven narrow blades, ranging in width from 6 mm to 8 mm, were also identified, the two complete blades (SF 52 and 70) are illustrated in Figure 9.3 and 9.4. One of the fragmentary blades (SF 65) appears to have been re-used as a tiny end scraper (Anne Graf, personal communication, 2002).

Although no re-fitting was possible among the Mesolithic material from trenches 3, 4, 16 and H, certain factors, including flint colours, textures and cortical survivals, suggest that the various flakes and tools might have originated from the same flint nodules and cores. This is particularly noticeable in trench 4, where a core-trimming flake was also recovered (SF 62). This evidence suggests that primary activities, including *in situ* knapping, were carried out in the vicinity of these trenches during the later Mesolithic period.

A number of typologically post-Mesolithic tools were recovered from the central zone of the site to the north of the main focus of Mesolithic activity. These tools are of a generally low standard of flintworking but included a Neolithic or Bronze Age piercer (SF 74), a Bronze Age discoidal-shaped scraper (SF 83) and various re-touched flakes (SF 163, SF 9 and SF 2), one of which may have been an aborted preform of a foliate arrowhead (SF 2) and another a possible knife (SF 9). Two barely modified large flake cores were also found (SF 72 and SF 145), which had been re-used as hammerstones, along with two flake cores (SF 84 and SF 85). Such cores are a feature of Neolithic (and later) river gravel assemblages where pebble flint has been unutilized from secondary sources, for example at Broom Heath (Wainwright, 1972), Wasperton (Bevan, 1996) and Runnymede Bridge (Bevan, unpublished).

The relatively small size of the late Mesolithic assemblage restricts any interpretation of prehistoric activity in the area beyond being able to identify evidence for knapping episodes. It seems that the earliest human presence at Croft took the form of a few visits to a riverine location to exploit seasonally available resources at some time during the later Mesolithic. There is limited evidence for tool making or maintenance activities, rather site-based tasks such as woodworking, hide processing or the manufacture of tools for hunting and fishing. This compares well with the established regional picture for the British Midlands, where Mesolithic landscape usage is known to have left few traces unless sites were used or re-visited many times, such as the hunting camp at Lightmarsh Farm, Worcestershire (Jackson *et al*., 1996).

The later phases of activity at Croft also appear to have been episodic and elusive, with Neolithic and Bronze Age tools being discarded as chance losses in the landscape, rather than resulting from settlement or activity of any duration. This again fits a regional pattern, with Neolithic settlement often appearing to be ephemeral in the river valleys themselves (Holgate, 1988). This was also seen at Oakham, where the flint again suggested a low level of landscape usage in the region during later periods (Bevan, forthcoming). This low level of use and deposition in the floodplain contrasts sharply with the large flint assemblage from near by barrow mounds such as at Lockington, Leicestershire (Young and Bevan, 2000).

General discussion of the sequence at Croft

Fluvial conditions

At Croft we appear to have a sedimentary sequence resembling that expected for a river that, if not actually anastomosing, is very mobile (*sensu* Smith, 1983). A major Holocene palaeochannel is subsequently re-cut by smaller Mesolithic, Neolithic and Iron Age high-energy streams, which incised and reworked extensive amounts of gravels, coarse sands and organic silts. This sequence of channel and floodplain development is thought to be common in the major lowland river systems in the early and late Holocene before the onset of alluviation (Macklin, 1999). Amongst the rivers that appear to show this pattern of channel development are the Severn (Brown, 1983), Trent (Salisbury, 1992; Knight and Howard, 1994, 1995, 2005), Nene (Brown and Keough, 1992), Welland (French *et al*., 1992), and possibly the Upper Thames (Robinson and Lambrick, 1984; Robinson, 1992). What is striking about the results from Croft is that this pattern of channel change, previously recorded from large channel systems, also occurs in this small, low-gradient headwater.

Brown *et al.* (1994) suggest that in the adjacent Soar valley there is a gap recorded in channel activity dating between *c.* 7500 BC and 2000 BC when the river became stable. This is a pattern repeated, to some extent, both in the Trent catchment and nationally (Knight and Howard, 1994, 1995, 2005; Macklin, 1999). The timing of channel activity in trench F at Croft appears to confirm this pattern, with material relating to middle and late Mesolithic and early in the Neolithic absent. Brown *et al*. (1994) also suggests that the water-tables in the Soar catchment rose after 3200 BC and, again, the presence of late Mesolithic sites in trench H at Croft below the present water-table appears to confirm this result.

There appear to be a number of distinct episodes of alluvial deposition at Croft that probably result from overbank flooding in two different periods. In both trenches F and H shallow clay horizons are present in the profiles. Radiocarbon dates may suggest an early Neolithic date for the former and a mid-Bronze Age date for the latter. Certainly these suggest that periodic, small-scale and local alluviation occurred throughout the mid-Holocene at Croft.

Limited layers of fine clay or silt deposition of Neolithic date have been recorded in a number of river valley systems such as the Kennet (Evans *et al*., 1988), various sites on the South Downs (Bell, 1983) and the Lower Welland and Nene valleys (French *et al*., 1992), as well as elsewhere in the British Isles (Macklin and Needham, 1992; Macklin, 1999). Often these have also been equated with periods of small-scale clearance in the pollen records (Brown, 1999; Richmond, 1999). However, the majority of these small-scale events are late Neolithic rather than early Neolithic in date (Macklin and Needham, 1992; Richmond, 1999). Equally, there appear to be no deposits of a similar nature and date so far encountered in either the adjacent Trent or Soar catchments at this time (Knight and Howard, 1994; Brown *et al*., 1994). It is entirely possible that small catchments such as the early Thurlaston Brook are particularly sensitive and, therefore, readily record such early small-scale events. However, the difficult nature of the radiocarbon date from this deposit in trench F also needs to be borne in mind.

At some point after the start of the Iron Age larger alluvial events occurred, resulting in the deposition of approximately 1 m of clay alluvium across the valley at Croft. An Iron Age or Early Roman date for the onset of this phenomenon compares well to that suggested for other locations in the Soar and Trent (Brown and Keough, 1992; Knight and Howard, 1994, 1995, 2005; Brown *et al*., 1994). This suggests that the headwaters were affected by this phenomenon at the same time as the main rivers in the area. The cause of large-scale Iron Age alluviation is still being debated, with climate (i.e., Macklin and Needham, 1992) and/or the intensification of Iron Age agriculture (i.e., Shotton, 1978; Buckland and Sadler, 1985; Limbrey, 1987) being offered as possible explanations. More recently this debate has centred on the extent to which these two apparent factors can act in tandem to change the nature of a river system's fluvial response (Macklin, 1999). Although the later phases of the pollen record of channel cut E do contain evidence for increasing clearance for agriculture, because of low dating resolution it is difficult to use this palaeobiological evidence to suggest that agricultural activity is the specific cause of the large-scale alluviation at Croft.

The changing landscape at Croft

Early Holocene

Analysis of the early Holocene peats (Units 3 and 7) at Croft suggests that open conditions with damp grassland, sedges and some birch and pine cover dominated throughout the early Holocene. This fits the established pattern for the central Midlands. Most of the available pollen data from this region indicate an initial expansion of juniper, followed by later, extensive development of birch across rich grasslands/meadows (e.g. Beales, 1980; Shackley and Hunt, 1984; Brown, 1988; Bartley and Morgan, 1990).

Neolithic woodlands

In the Neolithic, similar to most lowland river valleys, the area at Croft appears to be dominated by alder and, to a lesser extent, willow. The pollen suggests that the valley slopes were cloaked in a forest consisting of hazel, oak and lime with lesser amounts of birch and pine. The plant macrofossil remains and the insects also attest to the widespread occurrence of lime, supporting Greig's (1982) suggestion that this species dominated the majority of the lowland woods of the Midlands at this time.

Throughout the Neolithic deposits, pollen, plant macrofossil and insect evidence suggest the presence of small clearings. It is tempting to equate this evidence for clearing with the contemporary minor episodes of erosion and alluviation in trenches F and H. However, it is difficult to equate this specifically either with agriculture or the occurrence of pastoral grazing in Neolithic forests (i.e., Robinson, 2000). Such small-scale clearances could be caused by natural phenomena such as storm damage and fires started by lightning. Equally, the role of beavers and other wild grazing animals in keeping small clearances open has been widely discussed (Coles and Orme, 1983; Buckland and Edwards, 1984).

In terms of the reconstruction of the Neolithic woodland itself the results of the insect, plant macrofossil and pollen analysis are consistent with those from a number of Neolithic deposits in the Trent basin, including Kirby Muxloe on the Soar (A.G. Brown, personal communication, 2002), Langford Quarry (Howard *et al*., 1999), Bole Ings (Dinnin, 1997; Brayshay and Dinnin, 1999) and Girton (Dinnin, 1992). Insect records at Croft confirm the impression that Neolithic forests contained a rich and diverse fauna of tree- and deadwood-feeding species, and their associated predators. Some species, such as *Ernoporus caucasicus*, are today very endangered (Hyman and Parsons, 1992) despite their almost ubiquitous occurrence in pre-clearance woodland deposits throughout the Midlands. It is suggested that this diversity substantially declines with woodland clearance for farming in the later

Holocene (Buckland, 1979; Buckland and Dinnin, 1993; Dinnin, 1997; Whitehouse, 1997; Howard *et al*., 1999).

Later clearance

Pollen, plant macrofossil and insect remains at Croft suggest that between the formation of the Neolithic channel D and the initial incision of channel E the variety of tree species had decreased. Furthermore, by the time of the deposition of the upper levels of channel E most species of tree are essentially absent. This suggests a dramatic clearance of forest from the floodplain, the valley slopes and further afield. Alongside this, all of the biological indicators clearly suggest rises in the frequency of species associated with pasture, meadow and cultivation.

The evidence from Croft would therefore seem to fit Brown's (1988) suggestion that the selective felling or exploitation of trees resulted in a reduction in the variety of tree species in the woodland before later full clearance. Alternatively, it may be that clearance started on the adjacent valley slopes and edges before advancing onto the floodplain. The events at Croft also appear to correspond with the existing regional pattern. Increasing human impact on the vegetation of the Midlands during the Bronze and Iron Age periods is indicated in most pollen diagrams from the region (Barber and Twigger, 1987; Beales, 1980; Brown, 1984, 1988; Bartley and Morgan, 1990; Knight and Howard, 1994, 2005). More locally, Croft appears to compare well with the more complete sequence at Kirby Muxloe on the Soar (A.G. Brown, personal communication, 2002).

Conclusion

The work undertaken at Croft has given a valuable insight into how a small floodplain, such as that of Thurlston Brook, responds to changing climate and land use during the Holocene. Often, it appears to follow both regional and nation patterns, but there are times when the record seems to be more sensitive to events and the dating resolution possibly more controlled.

The excavation and postexcavation strategies followed at Croft have demonstrated that deposits from these small headwater catchments may contain enough suitable 'sedimentological windows' to provide a coherent picture of landscape and fluvial change for the Holocene. In the case of Croft it was possible to reconstruct, or 'stitch together', a coherent picture of events, as if the material had come from a continuous sequence. The success of this approach more than warrants the complexities of the fieldwork and care of postexcavation analysis needed. Croft has also shown that the combined sampling and analysis of a wide range of geoarchaeological and palaeoenvironmental techniques has the potential to dramatically enhance the interpretation of such sites.

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